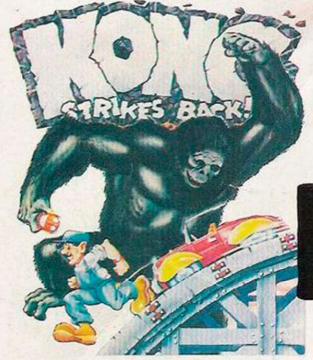


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your help, Rat Fans, to wind my way through the underground Rodent World of ladders, lifts,

bats and all kinds of creepy crawlies, where
I must find the keys to free my furry friends. I can't wait to use
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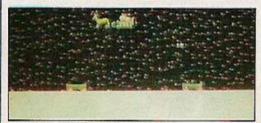
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Telsoft downloading service: page 64.



Yamaha CX-5M review: page 72.



Bill da Snowman: page 126.



BBC Darte: page 148 also on Telsoft.



Cover shot: Rediffusion simulator see pages 90 and 91.

48 LETTERS AND EDITORIAL: Sinclair Plus manual gripes, using a ZX printer with your QL and much more.

50NEWS: Domesday book, part two plus smashing time at the castle for YC readers and royal romps.

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64 SPECTRUM SOFTWARE, Paul Bond looks at Christmas presents.

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Four winners.

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Gyllerup writes some bright sprites.

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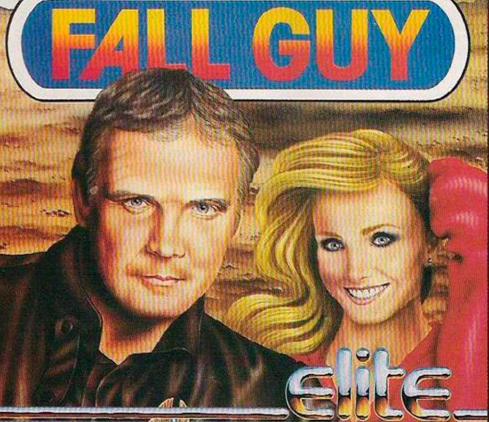
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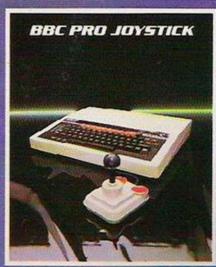
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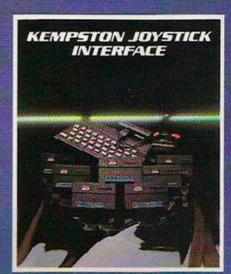
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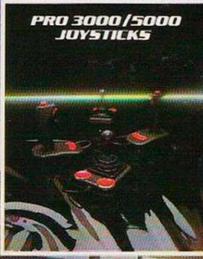
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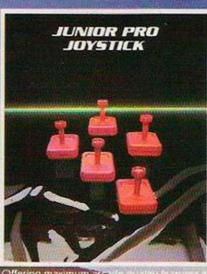
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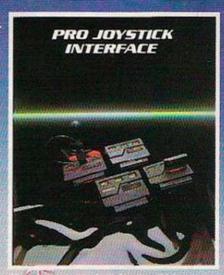


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Swords and Sorcery differs from other adventures in that you guide your character through the unending corridors of the underworld on a quest for material, physical and/or spiritual power. The choice is yours.

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There are quests within quests within Swords and Sorcery, for those who want to follow them. Some are given others | SPECTRUM 48K OR COMMODORE 64

must be found, and some are lost causes. There are many ways of opening the gate between the levels of the dun-geons. Some are obscure and easy, others obvious and dangerous. The most profitable paths are both. The Ultimate goal of many will be to find the lost armour of Zob, which was un-made by its maker, and its parts scattered across the levels. What, where, how, who and why are answers to be found. All that is known is the prayer of the seekers:

LET NOT THE RED CLUPEA HAR ANGUE US TURN US FROM WHAT SEEMS TREMENDOUS AND THUS TO ZOBS GREAT TREASURE SEND US.

You need never tire of Swords and Sorcery - when this dungeon can no longer hold you, the next awaits. . . there are a series of expansion modules planned to extend your enjoyment indefinitely.

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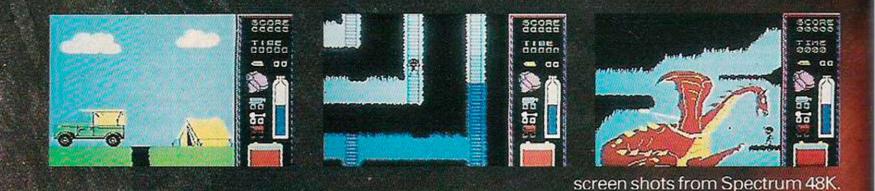
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Sounds tricky? – well it is and we haven't told you half of it.

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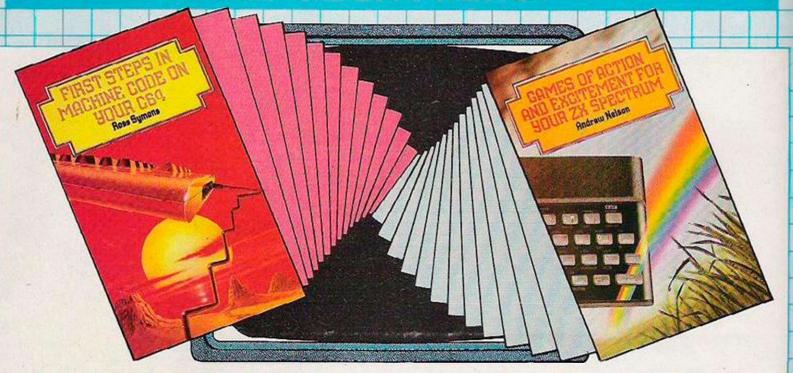
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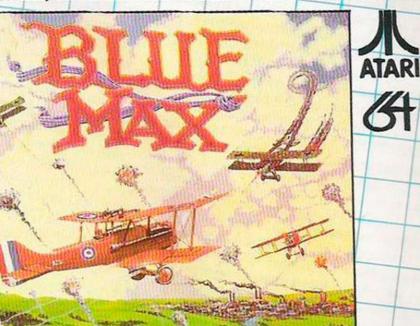
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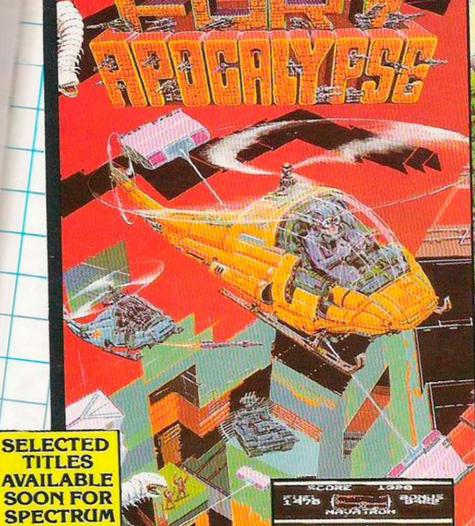
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You're at the controls for this World War I doglight game.

Shoot down enemy planes, bomb targets, strafe tanks and gun emplacements – there's constant action on the incredible 3-D diagonally scrolling screen. At the same time, you have to keep track of altitude, speed, fuel and damage. Medals don't come easy. You must master a scries of flying skills and perform them with piripoint accuracy. One slip and you've lost it all – even your life. Happy landings, ace!



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Commodore 64.

Home computers.

The report you've been waiting for: simple, factual, honest, comprehensive and 100% biased.

LL you need to know about computers can be summed up in one word: Commodore. [Well, we did tell you this would be biased).

We make everything you'll ever need to get the most out of home computing: all the hardware and all the software. [And if you don't understand what that means, simply look under "H"].

That's what these three pages are all about: explaining what computers are [without the scientific jargon), how

they work (without any technical mumbo-jumbo), and how you can get more enjoyment out of them (without much difficulty).

ASIC. Most home computers speak the same language. It's called BASIC. This is a more friendly way of saying "Beginners All-Purpose Symbolic Instruction Code."

There are different kinds of BASIC and, like languages, some are a little easier to understand than others. Like, BASIC 3.5 in the Commodore Plus/4 and Commodore 16.

BOOKS you can read: "Teach Yourself Computer Programming With The Commodore 64" and "Programmers Reference Guide"

ASSETTE. Just as you keep your favourite music on cassette, so you can also keep your favourite computer programs on cassette.

You can either buy pre-recorded programs in a shop, or you can write them yourself. Cassettes are just one form of program storage and playback -see also Cartridges and Disk Drive.

To play cassette software you need a cassette unit. The Commodore 1530 and 1531 cassette units have been specifically designed to get the very best out of our computers, and provide consistently reliable results.

CHIP: silicon. A very complex electrical circuit miniaturised in silicon. It carries out the functions in the computer. Unlike other home computer companies, we make our own chips, so maintaining quality.

ISK drive. A program and data storage system, just like

cassettes, but much faster. You can find and load the program you're looking for in seconds instead of minutes.

Diskettes, which can

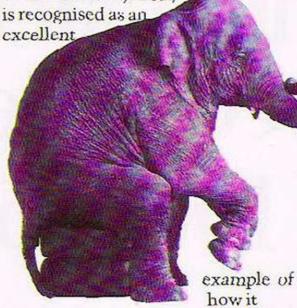
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be used repeatedly for recording or re-recording programs, transfer information or instructions to and from the computer.

DUCATION software from Commodore. We work non-stop with educationalists, improving our range of programs for the pre-school to "O" level age groups and beyond.

Computers are an invaluable educational toolversatile, patient and able to present information in an exciting way.

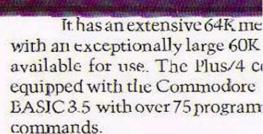
Our "GetReady to Read" series, with lovable B.J. Bear,



is possible to develop reading and writing skills in pre-school children.

ELEPHANT: wellknown symbol of the Commodore 64's enormous 64K memory. And don't you torget it!

OUR is for Commodore Plus/4, our very latest home computer with four, very popular built-in programs: wordprocessing, spread-sheet (financial planning), database (filing), and graphics.



Other features include se facilities, comprehensive graph and 121 colours.

> ORTEK and the Microchip unique programming co for children of all ages links learning exercises with a space adventure: GRAPHICS.

The pictures and diag on a monitor or TV scree either high or low resolu

All Commodore ho computers have 62 gra symbols to create low resolu pictures and diagrams, or

high resolution modes th allow you to specify each pixel (or dot) on the screen.

(There can be up to 64,000 of these).

GAMES: Commodore produce them all, and more! From shoot 'em up games, to games of adventure and complex strategy.

ELP! On both the Commodore 16 and Plus/4 computers there is a very special feature: aHELPkey.It does exactly what it. says: it helps you to debug which is the smart way of saying, "identify and correct errors") when you're programming.

It highlights errors right down windin dual instructions.

HARDWARE.

The computer itself-you can t it. Whereas software's a progran can only see or hear lon the mor when it's running in the comput





CARTRIDGES. These are programs that plug directly into the back of the computer itself.

CPU stands for Central Processing Unit. This is the computer's "brain," and as such it's what does all the hard work.

That is actually built into the computer, as on the Commodore Plus/1, the very latest in home computing.

INTRODUCTION to BASIC.
Just as you don't need to understand
how a car works to be able to drive it,
you don't have to understand how a
computer works to be able to use one.

But you will definitely get more enjoyment out of it if you do have a basic knowledge of programming.

Which is why "Introduction to BASIC" has become the most popular software tutorial.

It comprises 2 cassettes and an easy-to-follow, step-by-step manual.

INPUT/output: Input is information put into the computer from either the keyboard or a storage

device. Output is information from the computer to either a screen, printer or storage device.

As well as improving speed and accuracy, these make games more real by putting the control of whatever it is on the screen directly into your hands.

So "K" stands for a unit of 1,024 or 2¹⁰ A 64K byte memory unit contains 64 x 2¹⁰, or 65,536 bytes of memory.

And if you don't understand all that, don't worry.

All that's important is knowing you can run more complex programs through a computer with a large memory, than one with a small memory.

ANGUAGE. This is a system of coding that can be understood by a computer. It allows you to "speak" to the computer, and for the computer to "speak" to you. Most home computers speak BASIC, but there are also other languages available for

Commodore computers that have been designed for specific uses.

For example, LOGOs and PILOT in education.

ONITOR: this is the screen on which you can see what you've typed into the computer, and also what the computer is saying back to you. You can use an ordinary TV screen, but more preferable is a colour video monitor, like the Commodore 1701.

This is a special device that produces much higher resolution than a TV, and so offers superb reproduction and clarity.

On top of which it allows the rest of the family to stay tuned in to their favourite TV programme while you're tuned-in to your favourite computer program.

MODEMS allow computers to connect via a telephone line to other computer systems. Commodore 64 modem owners can communicate with other owners, join systems like Prestel/Micronet and an exciting new system called Compunet, where quality software is

available cheaply or even free.



MEMORY. There are two basic types of memory: ROM and RAM.

Read Only Memory (ROM) is the computer's permanent built in memory which tells the computer what to do. It doesn't disappear when the computer's switched off.

Random Access Memory

is for temporary storage.

It is the part of the computer's memory that's free for you to

use. It can be erased and used over and

over again.
It stores
both data and
instructions
during the execution of a computer
program. These are
lost when you switch
the machine off-unless,
of course you store them
on cassette or diskette.

TUMBER ONE. In the whole wide world, Commodore is No. 1 in microcomputers, and the Commodore 64 is the No. 1 best seller.



ORIGIN of the computer. In the
19th Century an Englishman,
Charles Babbage, invented the first true
computer. But his "Analytical Engine,"
was so ahead of its time, it turned out
to be impossible to build!

The modern computer first appeared around the time of World War II. Britain's "Colossus" was vast, consumed vast amounts of electricity, required its own air-conditioned room, was unreliable and difficult to operate.

It had its limitations.

Then came the amazing transistor, integrated circuits... and microcomputer

The first desk top microcomputer in the world was the Commodore PET (this was a friendly name for Personal Electronic Transactor), in 1977.

In effect Commodore had taken hitherto huge, expensive, mysterious machines accessable only to eggheads, reduced the size and price, and put them into the hands of ordinary mortals in ordinary offices. An extraordinary advance.

PERIPHERALS. These are separate add ons that will extend your computer's capabilities. Like our printers, storage devices and monitor

PRINTER: One of the ways a computer can "speak" to us.

It means you can produce charts letters, documents, pictures on paper The Commodore range includes four printers and one printer plotter.

The MPS 801 dot matrix printer (so called because its characters are made up of dots) has a print speed of 50 characters per second, about five times as fast as the fastest secretary.

The MPS 802 dot matrix friction

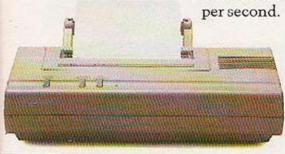
feed printer has a print speed of 60 characters per second and uses either single sheets or continuous stationery.



The DPS1101 daisy wheel printer (called that because, surprise, surprise, the print wheel looks a bit like a daisy), produces superb quality print on all letters, reports and documents (the kind of quality one desperately requires on a letter to the bank manager). There's a range of alternative type faces available on additional print wheels. Speed: 18 characters per second.

And the 1520 printer plotter (illustrated). This has 4 colours, and opens up a whole new world of graphic print-out ability. You can draw pictures, create graphic designs, plot graphs or construct bar and pie charts. Speed:

14 characters



WERTY - the 6 keys at the top left hand side of a standard typewriter. Unlike lesser machines, all Commodore computers have full-size, professional typewriter keyboards.

They have a solid, responsive feel to them. (The problem with rubber or membrane keyboards is they have a soft, spongy feel to them: you press a key, then wonder if the message

got through).

RANGE. The range of Commodorc software is enormous. There is something, as they say, for everyone: educational, business, home and games.

STARTER PACK. The
Commodore 16
Starter Pack has been
specially designed to
introduce you to computing.

It contains everything you need to start home computing, complete in one box: a 16K computer, cassette unit, four superb software programs, and Introduction to BASIC Part 1.

It has a *Help* key in case you get into difficulties, and incorporates advanced *BASIC*, which has been specifically designed to simplify the programming process.

Other features include: 4 cursor keys, 2 joystick ports, an astonishing 121 colours, plus excellent sound and graphics capabilities.

TUNES. Commodore make software to help you compose your very own music.

All our home computers have great sound and music capabilities.

SER friendly. This is a program that explains itself as it goes along, or a computer that people can easily operate.

Every computer manufacturer now claims its products are "user friendly," but only Commodore really

demonstrates it. For example, our *Help* key and use of Advanced *BΛSIC*.

VERTICAL integration is not as complicated as it sounds. All it means is that Commodore make everything to do with computers, from the silicon *chip* to the computer casing.

So we have complete control over everything, from design to manufacture.

It also means, of course, that we can design everything so you're able to get the very best out of your Commodore computer system.

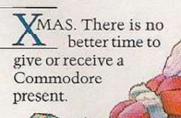
OMEN also are discovering computers - and not just in

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everyone, and the fact that they're fun, exciting, educational, practical and time-saving are benefits that apply to women just as much as to men.



YIPPEE! Yes, now you know

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about space games with horrendous
monsters. Nor are they horrendously
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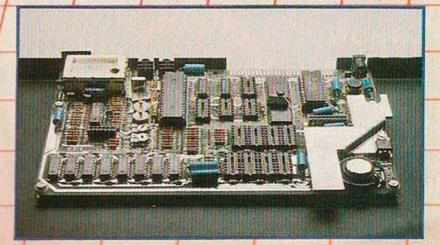


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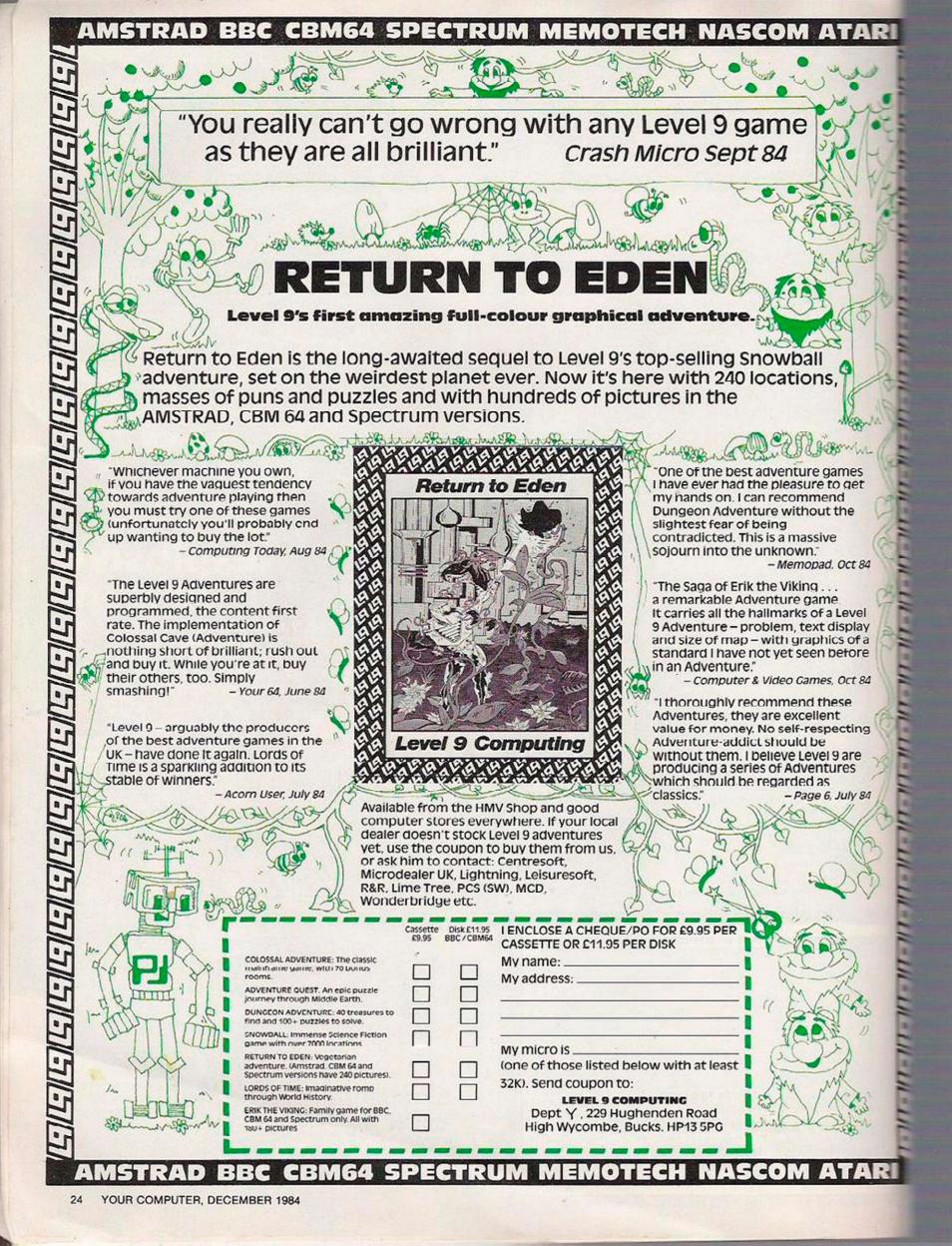
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Disk(s) of Interview _Tape(s)_ Rush me.

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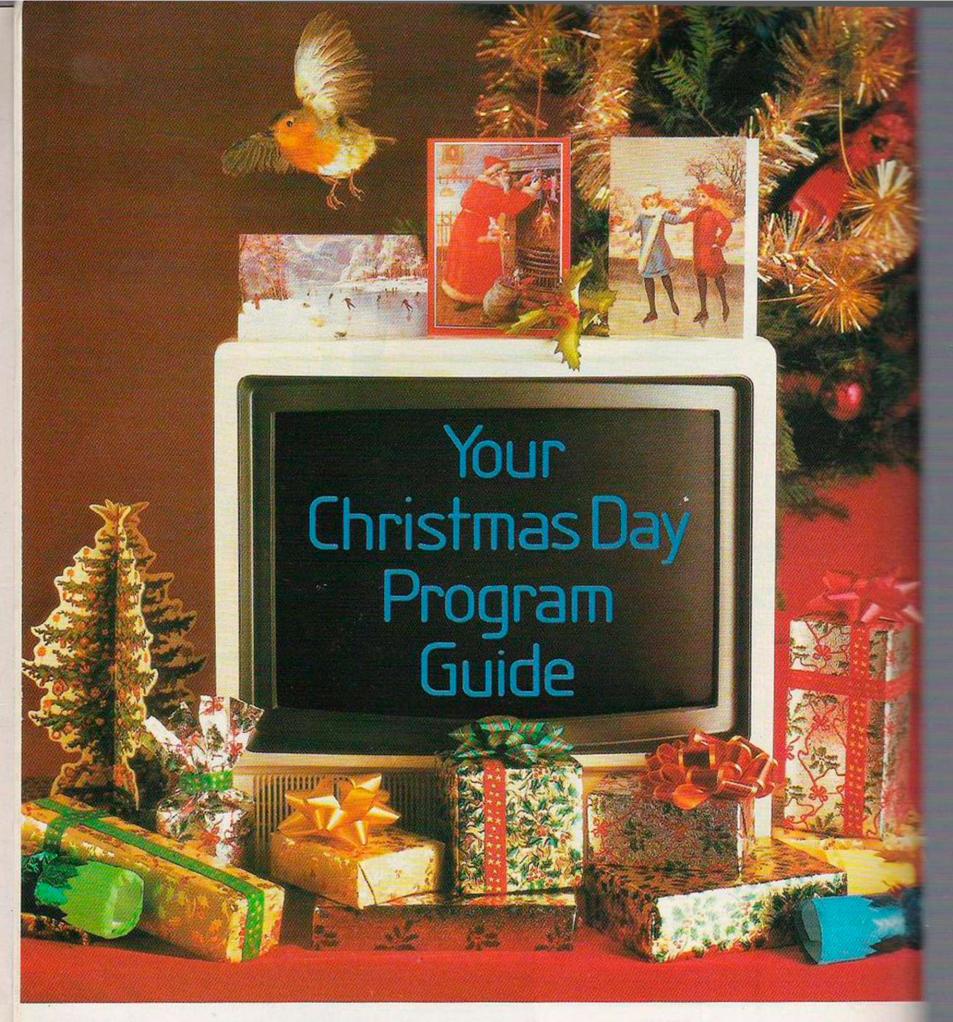
or debit my Access/Visa*_ Delete as applicable

I would like to hear news of more Front Runner

releases Yes

Please allow 21 days for delivery.





Acornsoft announce tidings of great joy for both BBCMicro and Electron owners: eight brand new programs for Christmas.

Each one makes an ideal stocking filler.
They're all available at your local
Acornsoft stockist. For the address or to order
by credit card simply ring 0933 79300.

Or you can send off for our catalogue by writing to Acornsoft, c/o Vector Marketing London Road, Wellingborough, Northand NN8 2RL.

Alternatively, however, you could always a chance and drop a line ACORNS to Father Christmas.

9.00 Firebug

A fast moving arcade-type game in which you are a fireman, trying to rescue some oil drums and take them to the safety of a water tank. Your opponent is the firebug who runs around lighting fires which move slowly towards the drums and fire extinguishers, destroying them if contact is made.

10.00 Maze

A gripping graphics game where you enter a top secret installation with the aim of stealing secrets from a rival company. The security system, however, has many levels each consisting of a maze of corridors patrolled by armed robot guards. Complete with full colour 3-D graphics, sound effects and a high score table.

12.00 Elite

A superb 3-dimensional graphics game that's light years ahead of any other. You are a space trader who roams the universe, making your living from buying and selling cargo in your Cobra space craft. On your travels, you will encounter aggressors who are cager to put an end to your dealings. Be warned, only the fittest will survive.

1.00 Crazy Tracer

A crazy adventure in which you guide a paint roller round the edge of a maze of rectangles, while avoiding the monsters which are trying to stop you by crushing the roller. Beware – as the game progresses, so the number of monsters chasing you will increase.

3.00 Go

'Go' is a board game for two players which originated in China 3000 years ago and is now more popular than Chess in the Far East. It requires strategic insight, intuition and a strong, calculating mind. If you wish, you can also challenge the computer at differing degrees of difficulty. A velly good game indeed.

4.00 Watch Your Weight

At last, a weight-loss program designed especially for you. With it, your computer becomes an expert wholly conversant with and sympathetic to your needs, and will help you choose an appropriate and individual weight-loss plan. The program also includes a calorie counter and a series of apposite menu suggestions to help stimulate your imagination when you just can't think what to eat.

5.00 The Complete Cocktail Maker

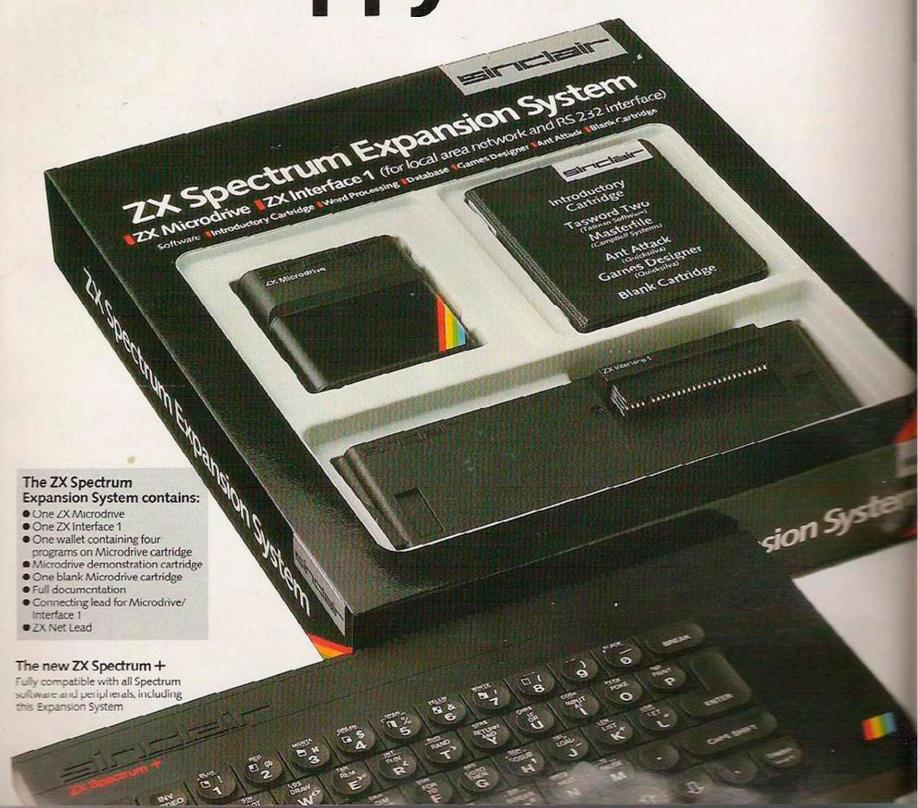
With everything from a Black Russian to a Betsy Ross, this program contains data sufficient to concoct a staggering 320 different cocktails.

6.00 Paul Daniels' Magic Show

Stun and amaze your friends with your astounding feats of magic. This program contains ten tricks to be performed by or with your BBC Micro/Electron. Hurry though – it's bound to disappear fast.

The ZX Spectrum Expansion System. Only £99.95

Sinclair's complete alternative to floppy discs...



Tasword Two word processor

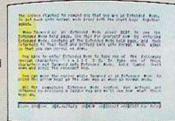
Turns your ZX Spectrum into a high-quality word

Tasword Two has all the essential features of professional word processing packages - move and copy, insert, margin settings, 'help' pages, find and replace, and much more.

Written by Tasman Software Ltd. Usual price (RRP): £13.90.

Masterfile filing system
Address lists...personal files...stock inventories...
stamp or album collections...club records...recipes ...if you can file it, you can Masterfile it!

Masterfile is a menu-driven filing and retrieval system of immense power. Display formats are userdefined, so the range of applications is enormous. Written by Campbell Systems Ltd. Usual price (RRP): £16.95.



THE PARTY OF THE P

Games Designer

Now, all you need to create original games are original ideas - and Games Designer! It has eight. very different, pre-programmed games for you to play as they are - or modify out of all recognition!

There's never before been an easier, more enjoyable, way into games design. Written by Quicksilva Ltd Usual price (RRP): £14.95.





Ant Attack

The all-time classic 3D strategy game. Ant Attack combines stunning Escher-like graphics with fastmoving action and a real tactical challenge.

Your task is to enter the walled city, seek out your captured partner, and escape. At all times you can choose from four angles of view. But beware: the city is patrolled by giant ants...

Written by Quicksilva Ltd. Usual price (RRP). £6.95.

All programs run on a 48K Spectrum or Spectrum +. Recommended retail prices are for each program on cassette.

...includes this Microdrive Expansion System ord great set of Ant Attack **Games Designer** Microdrive programs!

The unique ZX Microdrive system sets the Spectrum apart from all other home computers.

It gives you all the advantages of floppy disc drives - at a fraction of the cost. And tests show the Microdrives are faster than some disc drives.

> Now, the complete Microdrive system comes in one package together with four of the

best-ever Spectrum programs, on Microdrive cartridges.

This software alone would normally cost you over £50. Yet the Sinclair price for the complete ZX Spectrum Expansion Pack is just £99.95! You'll find full details of its contents

ZX Microdrives-another Sinclair first!

in the panel opposite.

The ZX Microdrive is a revolutionary fast access/mass storage device. And it's the only truly affordable alternative to disc drives ...

 Loads or saves up to 85K of program or data from Microdrive cartridges.

Just 3.5 seconds to access a typical file. computers using RS 232 (the industry-

 Only 9 seconds to load a typical 48K program.

The ZX Microdrive cartridge - a unique storage medium.

Smaller than a matchbox, the ZX Microdrive cartridge packs in a massive amount of data and programs.

Each Microdrive cartridge holds at least 85K bytes of data or programs (that's 30 pages of A4 lext). And you can store up to 50 different data files per cartridge, identified by titles of your choice.

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ZX Interface 1-adds powerful new capabilities to your Spectrum.

ZX Interface 1 connects to the back of your Spectrum and controls up to 8 Microdrives. (Additional Microdrives are available for £49.95 each.)

It also gives you:

 An RS 232 interface – to link your Spectrum with full-size printers, other standard interface) and provide data transmission over telephone lines, via modems.

•ZX Net – lets you set up a local area network of up to 64 Spectrums, for high-speed data communications between you and Spectrum-owning friends.

At your local Sinclair stockist-today!

The ZX Spectrum Expansion System adds an exciting new dimension to Spectrum and Spectrum + computing. At £99.95 it's superb value too.

To find out more, call in at your local Sinclair stockist now!

Sinclair Research Ltd. Camberley (0276) 685311.

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See the pack—see the screen—see the game. See the difference the moment you pick up one of the games from Firebird's new Silver Range.

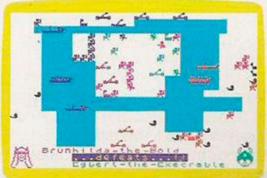
The difference is that our packs show the high quality you'll see on the screen when you play, so you know exactly what you're buying.

Here's a sneak look at three of the NEW games:



MR. FREEZE

Mr Freeze is faced with a real challenge. Armed with a flame thrower he has to determine a route through the fridge and de-ice each of its six compartments. This involves jumping over ice cubes and gaps between the shelves, and avoiding flying food, lasers and guardian robots. You'll need all your cunning, timing and skill to prevent Mr Freeze from being turned into ice. B-R-R-R!!!



VIKING RAIDERS

THRILL to the Vikings' exploits in this highly original war game. SAIL the Fjord in search of treasure and adventure. LEAD your armies in raids on enemy castles. CURSE at the uncontrollable antics of drunken Norsemen. MAY ODIN PROTECT YOU! For 1, 2, 3 or 4 players (any combination of human and/or computer controlled Viking armies).



DUCK!

Farmer Tubby is out to bag a few ducks, and maybe a swan, for his dinner. His trusty blunderbuss is small comfort against some of the zamy hazards and surprises he encounters Can you help him? This is the dathers, funniest duck-shoot of them all. A sense of humour is essential.

Look out for these games in the FIREBIRD silver range at selected high street stores.

SPECTRUM: THE WILD BUNCH BOOTY MR. FREEZE: TERRA FORCE: VIKING RAIDERS: MENACE: EXODUS: RUN BASY RUN CRAZY CALERNE COMMODORE 64: BOOTY: MR. FREEZE: EXODUS: HEADACHE: ZULU.

VIC 20: SNAKE BITE - MICKEY THE BRICKY.

BBC MICRO B: BIRD STRIKE - GOLD DIGGER - ACID DROPS DUCK!

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Unique technology: British made laminated glass, aspherically curved Contrast Enhancement Antiglare Filter.

Up to now, contrast-enhancing filters computer displays-unprotected screens have always been flat-and so has their TV, monitor or VDU is curved.

Up to now, most filters have been plastic — because it takes mindbending technology to bend optical quality laminated glass.

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manufactured by space age military technologists, CEAF is profiled to fit your display screen, giving you the ultimate in contrast enhancement and antiglare performance. For under £20, this first generation of eye-friendly filters diffuses all specular reflections, gives sharper image clarity from edge to edge of the screen and greatly enhances display colours.

Mounted and removed in seconds by invisible velcro fastenings, the antistatic, anti-shatter CEAF is a major step forward in the operational safety of

can cause blurred vision, watery and performance, because the screen of your itchy eyes, headaches and (according to such authorities as the Institute of Ophthalmology) even permanent changes in eyesight.

Scratch-resistant, durable and easily cleaned without expensive sprays and

agents, 9", 12" and 14" CEAFS are available from leading retailers at only £19.95 including VAT.

Or fill in the Freepost coupon and your CEAF will be despatched within 48 hours. Orders can also be placed around



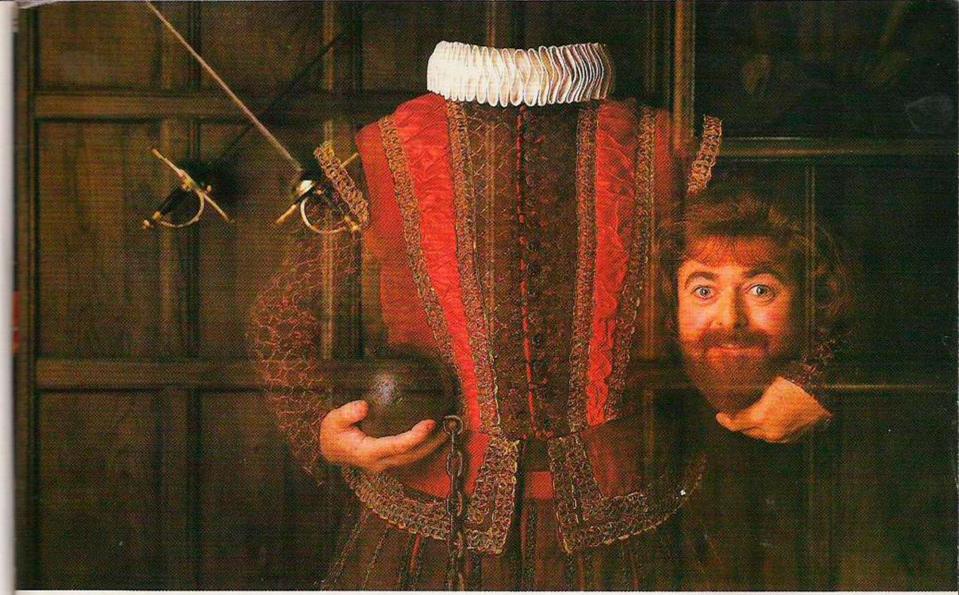
ROAD FROG by courtesy of Ocean Software.

the clock by phoning the CEAF Department on (091) 414 5511, quoting your Access Card number. For other screen sizes, please ring or writethe CEAF prices for 'specials' would be considered very competitive if there was any competition!

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The filter which eliminates all competition CEAF is a Registered Trade Mark



Education's a scream down at Spooky Manor.

Acornsoft have a range of education programs that encourage children to think logically and creatively. And at the same time, they make learning bags of fun.

SPOOKY MANOR: An adventure game for up to four players. Where exploring the creepy old house and solving mysteries involves co-operation and planning. It is suitable for children aged seven and upwards but many adults will enjoy the challenge it provides.

WORKSHOP: An easy to use and completely captivating program. Full of unusual machinery. By experiment children discover what each of the machines can do with simple geometric shapes. For ages three or over, Workshop encourages highly creative thinking and experimentation.

ABC: A writing tool designed for young writers aged seven and upwards. It is easily operated and quickly understood and before they realise it children will be creating and reshaping their words and ideas.

TALKBACK: Both entertaining and demanding.

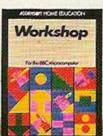
It allows children to create their own computer
'characters' capable of holding simple conversations on
the screen and provides valuable lessons in both English

and computer literacy. For ages ten and over.

All four programs are available for the BBC Micro computer on either cassette (£9.95) or disc (£11.50). Talkback and Workshop are also available for the Electron on cassette (£9.20).

For your local Acornsoft stockist or to order by credit card simply ring 0933 79300 during office hours. Alternatively you can order the programs by writing to Acornsoft, c/o Vector Marketing, London Road, Wellingborough, Northants. NN8 2RL, enclosing a cheque or postal order. Please allow 21 days for delivery.

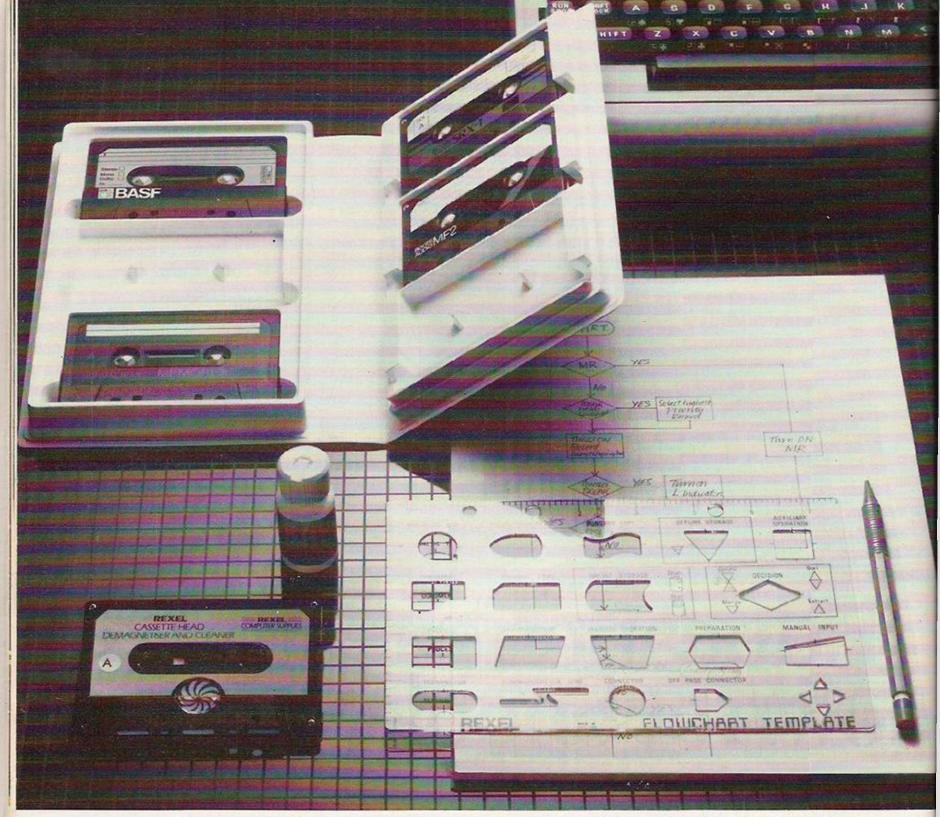








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operate and maintain your computer – cassette storage, programming, cleaning – all together in one complete kit.

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Compatible with every cassette driven micro, it is available now at W.H.Smith, John Menzies and other leading suppliers. And at £11.49 or less, it's an absolute gift.

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next. Or Celtic, then Rangers. Imagine that. Or you can play in your own team's colours against Liverpool...and thrash them. With International Football you get all the atmosphere of

O.K., so you like to think you can play football like Pele.

Well, now's your chance to prove it.

With the best football game that's ever been seen outside of Ccomm

Wembley. Not only is International Football startlingly life-like, but it gives you near perfect control over the players.

The ball's at their feet, and their feet are in your hands.

You can kick the ball and you can dribble it. You can pass it or even head it.

And every time you belt

the ball into the net, the crowd cheers madly.

How often you score depends on how good you are. It also depends on the level at which you choose to play.

SOFTWARE there are seven levels. From good amateur to... well, good professional.

Ore Altogether

You can choose the easiest level of play, so long as you don't expect a walk-over.

Or, if you fancy seeing what it's like to play in a Cup Final, then you can always choose the most difficult level.

a Cup Final spectacular in your

own front room.

Or play safe and choose

the computer. (But be warned, it plays

a pretty mean game does the

You can also choose your team's colours, and those of

It means you can play for Chelsea one day, and QPR the

At each level you're able to play either a friend or

somewhere in between.

Commodore 64).

the opposing team. Which is great.

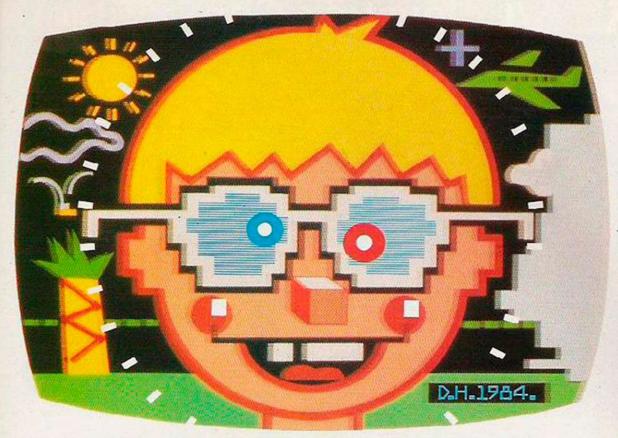
I he game is a real test of skill, dexterity and speed, and guaranteed to very quickly drive you football crazy.

Like all of our software, International Football has been designed to make the very most of our hardware.

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We're not the only people who think 'Art Master' and 'Picture Builder' are two quite exceptional computer graphics software programs.

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they'd never have agreed to put their name

to them.

With both 'Art Master' and 'Picture Builder' you can create full colour pictures on your own T.V. screen.

And believe us when we say those pictures will match the best computer graphics you have ever seen.

Anywhere.

The pictures are drawn using either the keyboard or a joystick, and can be stored

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With 'Picture Builder' you are presented with a palette of 121 colour shades (more than enough for any budding Michaelangelo).

And a collection of character sets totalling over 250 shapes.

So you're hardly stumped for choice.

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But this time you can draw whatever shapes you like, creating your very own high resolution masterpiece from a blank screen.

lt is even possible to draw circles, and store and then recall a back-up picture which is more than you can do with other graphics programs.

Everyone, from the six

year old right up to the 66 year old, will enjoy 'Art Master' and 'Picture Builder.'

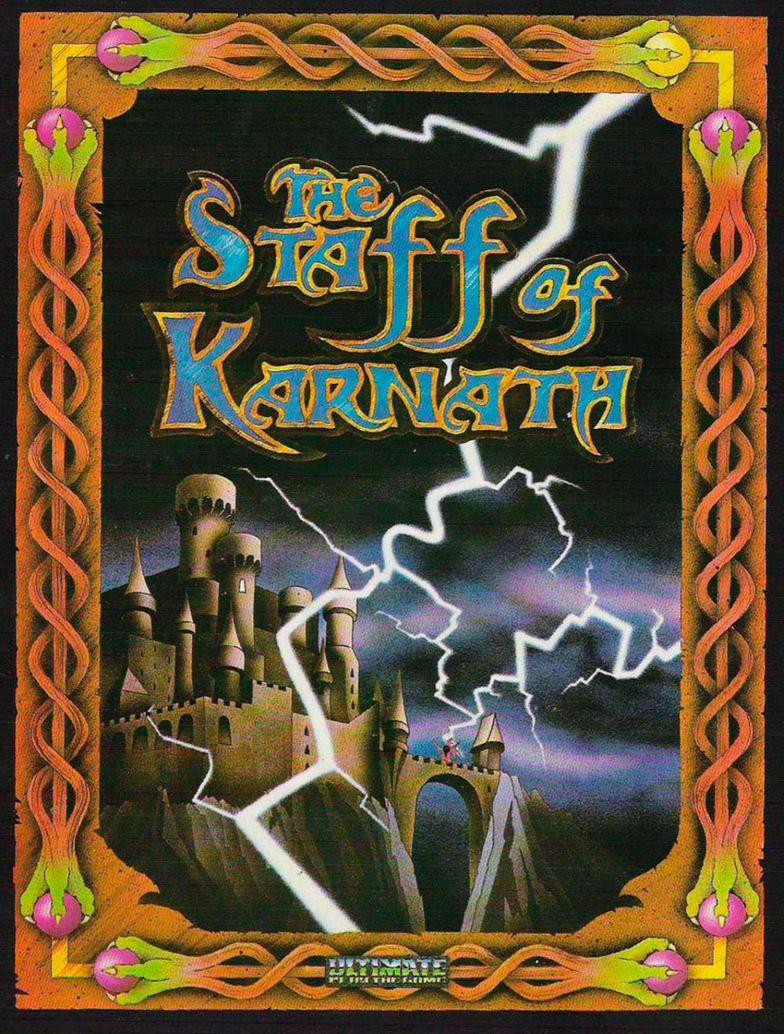
Like all of our software, they have been specifically designed to get the best out of Commodore hardware.

That's why you can't choose better.

Commodore software: it costs no more, even though there's more to it.

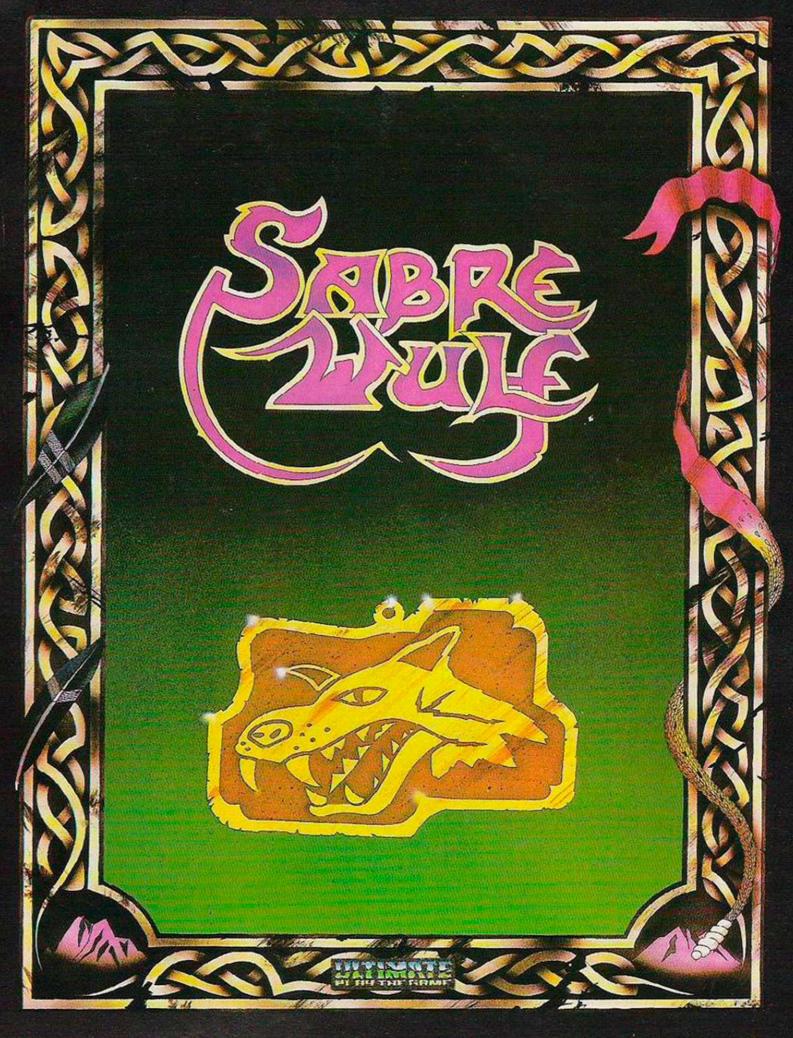


COMMODORE 64 (Joystick Compatible)



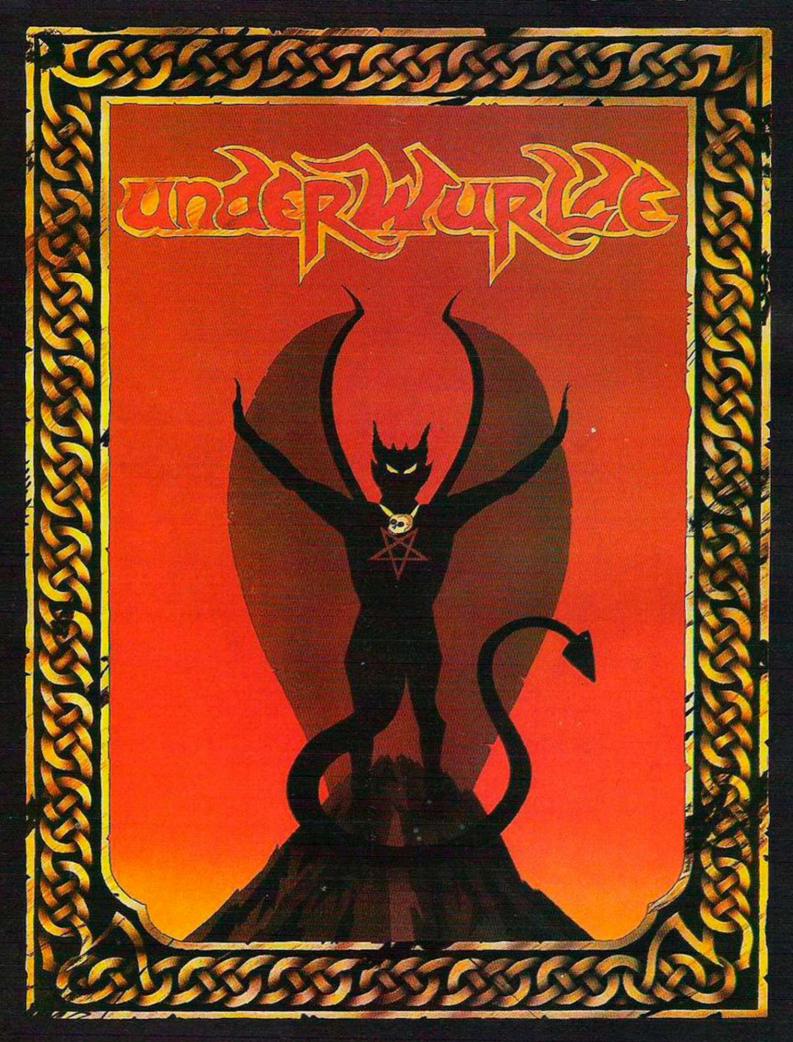
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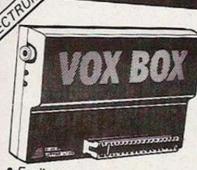
* Digital Sound Sampling has only previously been times the amount. * The Sound Sampling has only previously been times the amount. * The Sound Sampler allievs to to record 'Digitally' any sound into memory and instantly replay operations, plus on screen Voice Prints' + Frequency Protting. * With on screen keyboard e drum a single Sample Sound. * This is a professional unit "Although the unit is not a toy, giving truly astounding results for the musically inclined, we have Sound Samplier would be of interest to everyone.



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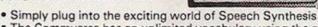
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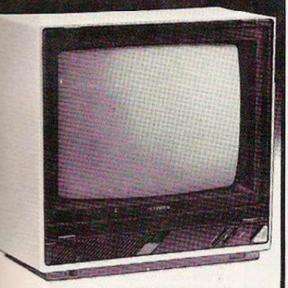
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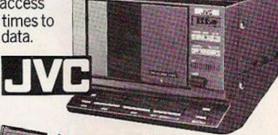
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SPECTRUM + MANUAL MINUSES

would like to report my experiences with the manual for the Spectrum+, and my first impression that it is a disaster is in no way diminished after thoroughly reading it through.

The manual has no ring binding so that it shuts up like a clam if you want to leave it open on the table while keying in a program from it. Having to use one hand to hold the book open surely defeats the object of having both hands available on the new key-

There is a mysterious back cover which has two folds and opens out to a total width of over 30cm. It's something like the Playboy centre page fold-out except that the girl as well as the clothes are

missing! I thought it might be a sort of bookmark where the flap could be folded into a page of text. But this is physically impossible. The fold does not overlap the page width - it underlaps it, falling short by several millimetres. Its purpose completely eludes me. Could someone enlighten me?



The manual of the "ordinary" Spectrum is written in a reasonably straightforward manner. At least I think so. If you wanted to find out about loops, you looked up the chapter on "Looping"; subroutines were dealt with in the chapter entitled "Gosub, Return". In the Spectrum+ manual these topics are covered in "Simple DIY Graphics" and "Designing Patterns and Pictures". And where, might one ask, can you learn about arrays and functions in the new manual? Well, that is not so Alan Crowe,

Bilthoven, Netherlands.

JOYSTICK GOLD

s it stands the Commodore 64 Program Bullion, printed in Your Computer September will not run. With the following changes all is OK: in line 8 instead of SR = 54292, change the SR to ZR; and in line 1500 change Poke SR,0 to Poke ZR,0.

Also I have included a joystick routine which other readers may like. Also you can still use the keyboard if you prefer. The following changes and Newlines must be entered.

0 Poke 56,140: Gosub 2000 170 Poke 198,0: SYS 35841

505 U = 35841

506 Read F: If F =

507 Poke U,F: U = U + 1 : Goto 506 508 Data 173,0,220,74,176,7,162,4, 134,197,76,0,192,74,176,7,

162,5,134,197 509 Data 76,0,192,74,176,7,162,12, 134,197,76,0,192,74,176,4, 162,20

510 Data 134,197,76,0,192, - 1

511 For T = 0 to 3: X = 0

512 Read A: If A = -1 then 530 520 Poke 49152 + T * 256 + x,A:

X = X + 1: Go to 512 990 Data 173,52,3,41,1,240,3,32,0, 201,173,52,3,41,2,240,3,32,

0,203,76,1,140, - 1 I do hope this will be of use to some readers. Thanks for an excellent

> T.7. Hackworth. Ruddington, Nottingham.

SQUEEZE TEXT

magazine.

n my article on text compression, published in September's Your Computer, line 910 of listing 3 was mis-typed. It should read: PRINT # 1; AT 1,0;

"Press any key to continue"

In addition, when the article was edited, some important details were omitted which could be of both value and interest to many readers. The structure of the 16-bit token is:

: 1 = a two byte token bits 1-11: dictionary item no. : 1 = begin word with

bit 12 capital : 1 = follow word by a bit 13

period :1 = follow word by a

comma bit 15 : 1 = follow word by a newline

It should be noted that the text dictionary corresponding to the example given in figure 1 has the phrase "you@are@in" as its first entry, "a" as its second entry, "dark" as its third entry, etc.

The points used by the compression routine are:

31535/31536 - Base address of

Dictionary 31537/31538 — Base address of Tokenised

Messages 31539/31540 - Next address in Dictionary

31541/31542 - Next address in Tokenised

Messages 31543/31544 - Number of

Dictionary items 31545/31546 - Number of Text

Messages 31547/31548 — Number of input

characters Number of letters in 31549 word/phrase being analysed.

The compression routine requires some work space immediately following the pointers so that the base addresses for the dictionary and tokens should be set, for example, at 32000 and 40000 respectively.

The degree of compression which may be achieved will depend obviously upon the nature of the text database. Typically, savings of 40-50 percent may be obtained using the text compression system described in the

> A. Tobias. Thornbury, Bristol.

TANKS CODE

'm writing to let you know that there seems to be a piece of code missing from my game Tanks. Below is a printout of the missing piece of code.

R. Ludkewicz, Wildmill Bridgend.

LOADING TROUBLE

was interested to read in Your Computer, October in the Response Frame section a letter concerning loading trouble. May I comment further on this?

Considerable loading trouble is obtained from tapes which are "data compressed" - classified under "Fast loading", "Turbo Jet", etc.

The standard tape deck cannot cope with such data compressing. Why try to turn a £200 machine into the equivalent of a £2,000 one? Does it greatly matter that 10 minutes loading should be compressed to two

Your correspondent will find that he is not unique with such loading problems. Mirrorsoft Ltd. have themselves kindly agreed to resupply a "normal tape" for a "data compressed" tape should trouble arise in loading.

Tim Hartnell gives good advice: "return to dealer and get one that loads!!".

> Eve Mills, Nailsea, Bristol.

MORE LIVES

irstly may I say what a brilliant magazine Your Computer is, being practically the only one to cater for us machine-code freaks. Taking J. Charlesworth's "Dangerous Gardens" as an example, the quality of the graphics and games play are up to "Ultimate" standard. It even surpasses "Pssst", on which I think it may be based.

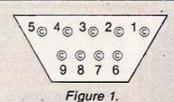
But onto the main point of my letter - re the aforementioned program, I can reveal how to get infinite lives! Simply add line 75:

POKE 28275,255

and you instantly have lots of lives. What disassembler did I use to find that out? Well, actually, I didn't - I simply took a method that I used on my 16K ZX-81 and transposed it into my Spectrum. It only takes up one line and could be used on any micro that uses Basic. The line is:

FOR I = START TO FINISH: PRINT I:"";PEEK I: NEXT I"

where Start = the start of the machine code and Finish = the end of the code. If the start of the code isn't known,



to Socket From QL GRND BLACK 7 GRND TXD IN WHITE 3 RXD OUT RXD OUT GREEN 2 TXD IN BLUE 5 CTS OUT **DTRIN** 4 DTR IN CTS OUT RED ORANGE OMIT Figure 2.

USING A ZX PRINTER WITH QL

f you already have a Spectrum with Interface I and a ZX printer and have upgraded to a QL as I have done, but can't justify a "proper" printer yet you may be interested in using your ZX printer for listings. The method I used is very simple and uses the serial 1 port on the QL and the 232 port on the Spectrum.

Firstly, you will need to wire up a 9-way plug - see diagram to the end of the free printer cable given with the QL. Remove the large plug by carefully unsoldering the six wires. Re-solder the wires to the 9-way plug as shown in figure 2.

Insert one end of the cable into SER1 of the QL and the other into the RS-232 socket on Interface 1. The following program must be entered into the Spectrum and Run. I used baud 600 for no particular reason.

10 FORMAT"t";600

20 OPEN#4;"t"

25 LET A\$ = INKEY\$#4

26 IF CODE A\$ = 10 THEN LET A\$ = CHR\$ 13: GOTO 30 27 IF CODE A\$<32 THEN GOTO 25

30 LPRINT A\$; 40 GOTO 25

Load a listing into the QL, and enter the following as direct commands:

> **BAUD 600** OPEN #6,SER1 LIST #6

Lo and behold, the ZX printer will spring into life and produce your QL listing!

EDITORIAL_

use the address that follows Rand USR or whatever method your machine uses to run machine-code programs. Then if, say, you wanted to change the amount of lives in a game where you start with three lives, simply write down all the addresses which have the Peek value of 3 and Poke each in turn with your desired amount of lives. Be prepared, however, to reload the program, should your Pokes crash the machine! This could mean a very long time waiting, especially if you own a Commodore 64. Long live Uncle Clive!

Jon Rose, Bognor Regis.

MIDWAY ERROR

feel I should correct a mistake in a brief review of Battle for Midway on page 51 of the November issue of Your Computer. In the review you state:

"All you have to do is sink the four Jap carriers and they all troop off the map, victory to you!" A gross over simplification of what is a very complex and historically accurate wargame.

The next line of your review says:

"So how come after sinking four carriers, you then get hit by aircraft and lose the game?" There are two ways I can answer this statement:

First, their are five aircraft carriers split between the three Japanese fleets. The first fleet has four carriers, the second one carrier and the third fleet, whilst not having any aircraft carriers, has the capability of launching seaplaines. I think that explains how your reviewer may have lost the game.

Secondly, the Japanese bombers have a flying time of 180 minutes. It is therefore quite possible for the planes to be launched and proceeding to attack the US fleets before any U.S. aircraft make an attack on the Japanese carriers.

Indeed, in the final stage of the actual battle, U.S. aircraft were attacking the last Japenese carrier at the same time as Japanese aircraft were attacking the U.S.S. Yorktown. By the time the Japanese had returned to where their carrier should have been, it had been sunk. Yet another way inw hich your reviewer could have lost the game.

As a final comment, I would like to say that while I am totally in favour of critical reviewing of products, I am rather disturbed that your reviewer has totally condemned our product in the eyes of your readers simply because he either didn't play the game for long enough or because he didn't take any notice of the information given by the program.

I understand that there are severe time constraints on any magazine article, but a quick telephone call to PSS would have explained to him that the program is not "fatally flawed" as he puts it.

Six months of research and design went into Midway

> Gary Mays, Managing Director, PSS, Coventry.

As winter sets in, Cold War computer games seem to reflect the chill in the political climate. On the same day that President Reagan was re-elected for "The Second American Revolution" — this time based on military muscle — and the Soviet Union was rattling its nuclear sabres around Red Square, the arcade adventure Raid over Moscow was launched.

Typical of the present crop, Raid over Moscow encourages you to take out Minsk, Leningrad and Saratov as the only way to save your hearths and homesteads. Although it was written by Mormon Bruce Carver in Salt Lake City, don't expect any Christian sentiments in this season of peace and goodwill to all men.

Even though the Americans have played ball in the game and dismantled their nuclear arsenal, the communists have reneged on Salt IV and their missiles are speeding towards targets in North America: "The Soviets believe their treachery will lead to total world domination."

U.S. Gold, the U.K. distributor of the game, says that despite the "elements of violence and political overtones" the program is "escapism and not indoctrination" and might just as well have been called "Raid over Birkenhead" for all the offence it should cause.

But before you conclude that all violence and aggression in computer games originates in the West, it's worth noting that a Yugoslavian team of programmers recently came up with an amusing little number which, roughly translated, goes by the name of Sink The Nato Fleet. Perhaps if the Eastern Bloc home computer market were not so limited we would see more of the Warsaw Pact's

equivalents of Raid over Moscow.

Few of these overtly war-mongering computer games have been produced in the U.K., although in mid-1982 Bomb Buenos Aires was released by a British software house to cash in on the Falklands conflict.

Taken at its most extreme, the lobby against violence in games would argue that even zapping aliens is wrong. Christian Penfold of Automata—the software house that champions non-destructive computer games—believes that any form of onscreen killing makes people more insensitive to violence in real life and more likely to commit it.

That is a difficult argument to prove and not even he would put shoot-'em-ups on a par with video nasties like *Driller Killer* even though the effects of such games may be more insidious.

The middle ground in the controversy puts games like Raid over Moscow and F-15 Strike Eagle, where you have a choice of targets in Libya, Syria and Vietnam, into the overtly propagandist category. But despite their equally violent underlying mesage, programs with a historical perspective — like the World War II Eastern Front for the Atari — are more acceptable.

Until some sort of standards are set you will have to pick your way between Automata's ultra-pacifist line — "Killing is wrong, even pretend killing on little screens" as it says in their game Deus Ex Machina — and Cold War jingoism.

So much for the Christmas spirit — Good King Wenceslas would be a legitimate target, after all he was Czechoslovakian — the only thing that looks like being deep and crisp and even on your yuletide screens is the fallout from a nuclear winter.

How to write for Your Computer

We called this magazine Your Computer precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer—you can always use a friend's or user group's

this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Why not give it a try? You have nothing to lose but your postage.

 ABC

January-June, 1984.

154,334

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Subscriptions: U.K. £12.50 for 12 issues.

Printed in Great Britain for the proprietors
Business Press International Ltd, Quadrant House, The
Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-651 3500
Telex/grams: 892084 BIPRESG, ISSN 0263-0895.
Printed by Riverside Press Ltd, Whitstable, Kent, and
typeset by Instep Ltd, London EC1.

Advertisement Manager NICK RATNIEKS 01-661 3127

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Group Advertisement Manager SHOBHAN GAJJAR Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. © Business Press International Ltd 1984

dogfight

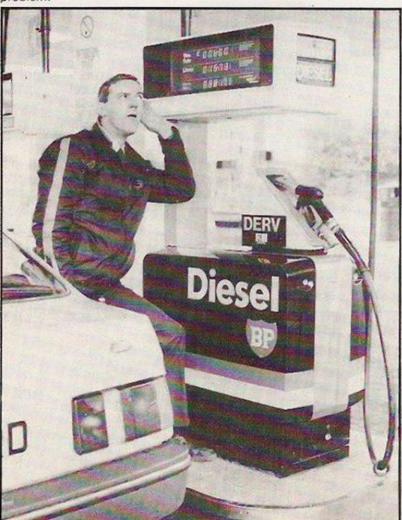
F-15 STRIKE Eagle is the homegrown all-American flight simulator which may be involved in a bit of a dogfight sales-wise with Digital Integration's Fighter Pilot. Both simulators are based on the F-15 air superiority fighter; both have now been implemented for the Commodore 64.

Strike Eagle from US Gold was originally implemented on the Apple II and is available for the Atari, too.

Opponents, according to the manual, include the Mikoyan/ Gurevich Mig-21. Mig-23, and Sukhoi Su-22, though in fact they all tend to look rather like flying triangles.

This particular graphic gripe apart, the rest of the game has great complexity and depth. You can select forward and rear views à la Star Raiders by pressing the space bar, and the head-up display shows your airspeed, altitude, and line of flight. It also gives you two reticles (American for cross-hairs) one for aiming guns and missiles, another for aiming bombs. There are two target designator boxes, one for aircraft which are too far away for you to see, and one for indicating the position of air or ground launched missiles. You can also release decoy flares.

"Typical Ford Sierra driver - listen cloth ears this is a diesel pump". Gilbarco's new petrol pump uses a Texas Instruments speech chip to remind bleary-eyed motorists that they have gone to the diesel pump perhaps by mistake. Every year thousands of petrol engines are ruined as dull brained drivers fill up petrol engines with diesel. BP already paints diesel pumps black and petrol white to differentiate them but now hopes that the new Gilbarco pumps will get rid of the



A supersonic Your Computer prize-winners save maiden from fate worse than death

SEVEN "YOUR COMPUTER" prizewinners diced with death as they fought their way round Treasure Trap Castle. The prize-winners from our March competition were treated to the dubious delights of a real life adventure at Peckforton Castle in Cheshire. Their adventures followed the plot of Castle of Terror, a Dracula type graphics adventure set in the 1800's soon to be released by Melbourne House.

The Castle is rented out by the local landowner to Treasure Trap who use it to stage fantasy adventures in its buildings and grounds. These adventures are based around the rules and ideas in the game Dungeons and Dragons (TM), but instead of moving small plastic models around a cardboard map, participants try to fight their way round rooms and corridors of the castle, often in the pitch dark, opposed by large 'Orcs' wielding bottles of red dye. People come back time and time again. One seasoned campaigner we came across said that on a good weekend he could expect to get killed half a dozen times at

Certainly our prize winners



Two of our prize-winners, Alan Berg and Steven Rhodes, have a slight difference of opinion with a couple of Orcs.

enjoyed themselves, and give or take a reincarnation or two, they all came out in one piece, with Dracula suitably disposed of and the fair

maiden rescued, although what the laundry service will say about the state of their clothes is another matter.

"We are not amused"

SATURATION POLICING and improved surveillance since a certain Mr Fagan supped a bottle of wine in the

Hal joins the

HAL BERTRAM has become the first to reach "Elite" status in the Acornsoft game of the same name. On Saturday, 3rd November, at 11.39 with as much due pomp and ceremony as you get from the BBC's sound system, he was admitted into the hallowed fellowship of the great immortals of computer gaming.

Queen's bedroom have at least reduced the number of German tourists camping in the grounds of Buckingham Palace but they have done nothing to deter electronic burglars from breaking into Prince Philip's British Telecom postbox.

It's been a bad couple of weeks for the royals at the hands of computer enthusiasts and not just Prince Philip. A German magazine had offered a £500 bribe to a British hacker to break into computers holding details of Princess Diana's credit card payments - loyally they had refused.

What do you get if you cross a turtle with a plotter? The Penman robot plotter seems to be the answer. It can make three colour posters chugging around on the paper leaving a trail behind it, or behave like a traditional turtle. Penman comes with BBC software for £250 but will interface to any micro with an RS-232 port.



Schools are to condense the history of the country — part two — onto a pair of videodiscs

THE DOMESDAY Project may sound like the next American arms program but is in fact a latterday version of William the Conqueror's Domesday Book. BBC Enterprises have launched the £2½ million project with the idea of compiling a comprehensive survey of modern Britain.

But instead of storing the information on paper it will be held on videodiscs. The system will use a videodisc player driven by a BBC micro.

When the Domesday Disc package is completed in September 1986 — the 900th anniversary of the original Domesday Book — the amount of information it stores will be equivalent to two full sets of the Encyclopaedia Britannica: two million pages of text, figures, and maps, plus 85,000 photographs.

All this will be held on just two videodiscs. The first disc will provide local information. Sitting at your BBC micro you will be able to call up a map of Britain, pinpoint an area with the cursor and then zoom in to a large scale Ordinance Survey map of the area. From there you could read 20 pages of information on the locality, or convert the data into coloured overlays on the map—showing green belt areas, voting patterns, and so on.

The second disc will contain national data — everything from population statistics to details of flora and fauna.

YC goes down the line



Now YOU CAN dial Your Computer any time day or night and with the help of your modem leave us an instant message. Just ring (01) 661 8978 and wait for the tone after our modem answers the phone. Connect your modem then transmit the address code YRC - making sure you use capital letters only. The acceptance code +++STF GO signifies that all is well, then you can transmit your text using upper and lower case letters, For the attention ..., From..., Phone No..., Address..., and your message. When you have finished the end of message code is NNNN - in capitals only. Our modem is V21 specification with 300 Baud speed, even parity and 10 bits per character.

To collect some of the information the BBC is hoping to enlist the aid of 10,000 schools, whose pupils will compile portraits of their areas. Other sources are to include databanks such as the National Data Archive.

The keyword in this project is "interactive". By interacting with the videodisc player the BBC micro will allow you to call up pictures and text on any particular topic. It will also load in programs to manipulate the data and overlay the pictures with high res graphics.

Acorn are writing the software for the system, while Philips are developing a new type of Laservision player capable of storing both digital data and pictures. The whole package which includes the videodisc unit, the discs, and an operating system for the BBC micro, will cost around £1100.

Frontrunner — wait for it

IN THE NOVERMBER issue of Your Computer we mistakenly ran an advert for Frontrunner's new game Dead City rescue. We are told by Frontrunner that the game will not be ready until the New Year.

COMPUTER TOP 20

Chiller	Master-	CBM 64
	tronic	
ECombat Lynx	Durell	Spectrum
Daley Thompson	Ocean	Spectrum
Decathlon	A	
Danger	Creative	Spectrum
Mouse in	Sparks	

All the second second
ft BBC
BBC
BBC
CBM 64
Spectru

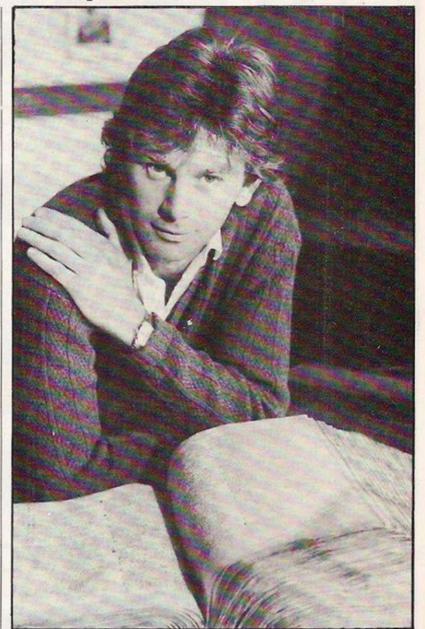
P.C. Fuzz Mr Micro Vic 20
Sherlock Melbourne CBM 64
House CBM 64
House Ace US Gold CBM 64
Summer Games Quicksilver CBM 64
Tornado Vortex Spectrum

US Gold

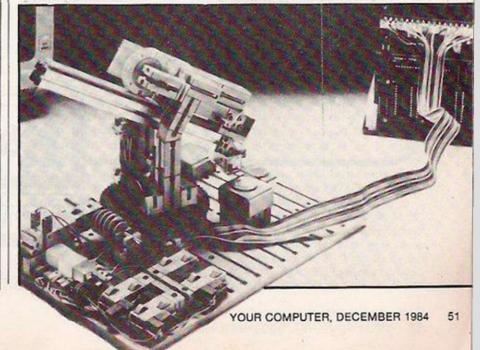
CBM 64

Low Level

Zaxxon



From BBC Buggy builders Fischertechnik this new robot arm is one of six models which can be built using a £65 robitics kit. The kit includes motors, potentiometers, micro switches, and an electro magnet as well as a Meccano-style construction kit. With these you can build an assortment of robot arms and even a tracking mechanism which could be used to follow a star across the night sky. The arms can be operated by a Spectrum, BBC or Commodore 64 — the only snag is that the interfaces can cost as much as £50.



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could

October's competition asked you to write a program which would rotate a square about any centre. So long as you knew the necessary transformation matrices this was a fairly simple task, and most of the programs submitted adopted the same approach.

We awarded the £15 prize to David Murphy, Bolhalel House, Llangunnor, Carmarthen, Dyfed. We judged his program the shortest and simplest. Admittedly it takes advantage of BBC Basic's superior power and economy.

Line 250, in particular, would be difficult to convert to other Basics. It draws a line in the logical inverse colour of the old pixel colour. In other words it either draws a square or blanks it out. This allows the program to erase squares after they have been rotated.

If you would prefer to keep all the squares on the screen replace Gosub 230 in line 130 with Rem.

The other important lines are 150 and 160 which calculate the new coordinates.

For this month's competition we are setting you another exercise in artificial intelligence. Write a program to play noughts and crosses on a 3 by 3 grid. The shorter the listing the better.

You could include a routine to handle the computer's playing strategy but it would be more interesting to make the program learn from experience.

After 10 or so games it should be able to draw every time.

Starting out in home computing? First Bytes is for you. Just write to Your Computer with any hardware or software problems, no matter how small or simple.



-processing makes it easy

MENTION WORD-PROCESSING and most people think of huge £3,000 dedicated machines which require trained operators. Above all you think of work: typing, letters, memos hardly what home micros are all about. But things are changing.

Word-processing programs have been around for some time for most machines - though on some, like the Spectrum, they have been pretty much of a joke because of the poor keyboards. Now, however, manufacturers are not only beginning to produce machines that are suitable for word-processing, but they are even throwing in a program with the machine. Both the QL and Commodore's Plus 4 have good keyboards and bundled word-processing packages. It can only be a matter of time before some of the MSX machines and others do likewise.

Once you have coded each letter as a number - using ASCII, or American Standard Code for Information Interchange - then a computer will happily manipulate them like strings of digits. In fact micros are so good at pushing words around the only problem is that you will never want to use anything else.

You don't even have to be able to type to use a word-processor. You can make as many mistakes as you like, change your mind as often as you like, and need never have to worry about layout and presentation. The only limitation in terms of output is the quality of the paper and printer you

Apart from this obvious basic ability to change things, perhaps the main feature of word-processing is wordwrap. This simply means that at the end of the screen you do not have to type carriage return. The micro will notice that you have exceeded the specified width and take over the current word to the next line. It will also only take over whole words: ordinary screen handling routines in Basic break words anyhow when you go off the screen.

Related to this is justification. When you type on an ordinary typewriter, the left-hand margin is nicely lined up, but the right-hand one is all over the place. Justification is the process of spreading things out - usually by inserting spaces between words that both sides line up, as in this column.

You should also be able to centre text. This means that a group of words will be placed neatly in the middle of a line with equal space either side. All of these features help you make the layout more attractive, as do facilities like underlining, boldface and italic scripts.

Word-processing also allows you to make radical structural alterations. It often happens that when you get to the end of some carefully typed letter, you realise you should have put that last paragraph in at the top. Not only does a word-processing program let you do that, it will even save you the effort of re-typing it all. The process is called a block move.

First you define the words to be moved. This might be a paragraph or group of sentences. Next you mark the point where the block is to be moved to. You then have two options. (continued on page 55)

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(continued from page 53)

Either you can make a copy of that block, leaving the original block intact, or you can move it entirely.

A facility drawing on the computer's ability to perform mindlessly repetitive tasks quickly is search and replace. Looking through a long text for a particular name or word is a tedious process, but a micro just laps it up. Once it has been found, most word-processing software offers you the option of going on to the next occurence or replacing the one just found. Some programs even let you specify the word and its replacement, which is then carried out throughout the document. This could be useful when you have consistently mis-spelt

someone's name.

The specific way that a program does these things, and shows them on screen, varies widely. Some a use complicated strings of commands that you have to memorise, others use function keys, and others the first letters of words like Search and Block. Some programs cannot show bold or centred text on the screen, though they can produce it on the printer. The best type of word-processors are called WYSIWYG. What You See Is What You Get. The screens show exactly what will come out on the printer.

Often, though, your text will contain all sorts of hieroglyphics which letters — say a Christmas thank you mark where blocks begin or italics note — but with gaps left for the

page of the page o

is mailmerge.

Mailmerge is a very powerful facility that lets you set up standard letters — say a Christmas thank you

gaps you place special codes that refer to another file that contains the missing information. At the time of printing you instruct the computer to fill in the missing details from the other file you have set up.

The fine art of frying up the perfect chip

EVERYBODY KNOWS that at the heart of the micro are its silicon chips. After all, there have been enough bad jokes about chips with everything, chip off the old block and chipshops. But as people blast a few more thousand aliens into kingdom come, they tend to take its amazing technology for granted.

Externally, chips look pretty unexciting. Along both sides of a dark rectangular epoxy case, about 40 metal pins emerge. These are simply the connections to the tiny sliver of silicon inside. This is about 5mm square and 1mm thick. Yet within this small area there may be crammed something like 50,000 components.

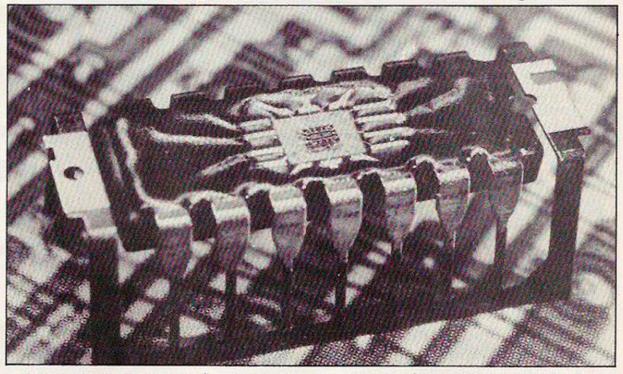
The idea is simple. Imagine a computer built up out of standard components like the transistors you might find in a cheap radio. This is in fact precisely how computers were built in prehistoric times — that is about 25 years ago — which is why big mainframes filled rooms. Most of the bulk is taken up by casings and wiring. In fact transistors don't need to be big at all: they are used just as switches, either on or off, to represent the binary 1s and 0s used by computers.

So reduce them to mere specks of silicon, without casings. Then pop it into an oven, and let it melt — in a controlled way. You then have a small slice of silicon that has all the components built into it. This is a chip.

Of course, the techniques used to produce modern-day chips are rather different, but they do draw on the same idea of one lump of silicon with lots of microscopic components.

The transistors used in radios and chips are essentially sandwiches of different flavours of silicon. A chip is built up by starting with the bottom slice of silicon, and adding successive layers of silicon, which are "doped" with tiny quantities of other elements to give the different flavours. Special techniques are used to melt these different layers together.

The individual transistors are created from this "chip sandwich" by etching away some or all of these layers. A transistor is like a tiny island of exotic silicon rising out of the bottom layer. Microscopic conducting bridges can be built between these islands to link the transistors together



in electronic circuits. The way you connect them determines what type of chip you have. The basic technology is the same for them all.

Chips have become more and more powerful as ways of making these islands smaller and smaller have been devised. The other design problem is working out how to fit them all onto the chip, and in particular in such a way that connections do not cross.

To do this with 50,000 components requires a powerful computer and advanced graphics programs. At the end of the day, the chip design is effectively drawn on a huge piece of paper. This is then photographically reduced to the size of the chip. By projecting it onto a photographic film placed on the surface of the silicon sandwich, it is possible to map out the islands that become the transistors.

There are two main categories of chips: processors and memories. The processor is the workhorse of the micro. It does all the calculating and generally keeps things running. It will normally have a main adding device and various storage areas. These will hold data briefly before it is manipulated, and also note things like whether the result of calculation is zero or negative. A record is also kept of where the next instruction or data is to come from.

Memory chips are simply huge arrays of transistor devices, each of which can be addressed individually, and which can store a 0 or 1. Thus chips that have a memory capacity of 16K have over 16,000 separate devices that can be individually selected, and then read or altered. Clearly, the internal wiring problems of keeping all the lines for finding and accessing particular locations tidy on the chip are horrendous.

Another problem with Ram and processor chips is heat. All the time that a chip is running it is drawing electrical power. Flipping a 0 into a 1 or vice versa uses energy that eventually appears as heat. This has actually been a constraint on chip size. It is theoretically possible to build extremely small chips that would actually melt themselves as soon as you used them.

So, gradually new technologies in chip design have been evolved to overcome this. These have yet to filter down to the low end of the home micro market, but it is not far off. For example, Apple's new incarnation of the Apple II, the IIc, uses this technology, as do the small lap portable computers.

Rom chips do not suffer from this problem so much. Since these readonly memory devices cannot be changed there is no need to keep on pumping electricity through them to keep them active.

There is one variety of Rom which is unfortunately becoming more common in new micros. This is the PRom or programmable read-only memory. They are Roms that do not come with the program already built into them using the same silicon island techniques for Rams and processors, but are supplied as clean slates. You can then reset some of the devices to the values you want. This is much quicker than designing a whole new chip. Which is why manufacturers who are in a hurry to get a machine out use them—e.g., the Sinclair QL.

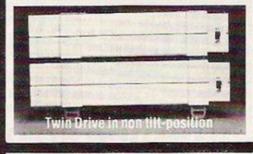
Finally, there is a type of general purpose chip, called the ULA - the uncommitted logic array. Like the PRom, this allows a micro manufacturer a certain freedom to reprogram it for its own needs. Unlike the PRom, though, it represents an acceptable way of saving money and board space. They also point the way of the future. Some of the most advanced chips now coming though are complex multi-purpose devices that not only have processors but memory on board too - in other words almost a complete computer. These really will be chips with every-

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Local news

Penwith

Penwith area Independent Computer Club meet at St. Paul's Old School, Taroveor Road, Penzance. Contact Jeremy Hewitt, Club Secretary on Penzance 787159. Holds meetings and rallies where local software and hardware distributors display their wares.

Gloucester

A Spectrum user group meets weekly on Wednesday or Thursday. Contact Barry Ledbury on 0452 23186.

ZX Exchange

ZX-81 owner? Feeling lonely with all these flash Spectrum owners kicking bytes in your face? You need ZX Exchange, the only remaining international postal forum exclusively for the ZX-81. Provides a bi-monthly newsletter, software, tips and listings. Contact Nick Goodwin on 0390 50965.

Waterford

Waterford, Eire, is the home town of OIFIGiuil, which is Irish for the Official Irish Forth Interest Group. Recognised by FIG(USA) potential membership is widespread - Dublin, Mayo, Cork. More details are available from Hugh Dobbs, Newton School, Waterford, Eire.

Stoke

Mixed Bytes Computer Club meets at Dilhorne New Road Recreation Centre, near Stoke-on-Trent on every other Thursday from 7.30 to 9.30. Contact Alan Cope on 0782 396003.

COMPUTER Lee Paddon visits the Medway Computer Club and can't find a Pac-Man or Space Invader in sight - but he does discover The Last One!

WALDERSLADE SOUNDS as though it would be more at home in The Archers than in the middle of Kent. Despite this, your intrepid reporter followed his instructions and soon found himself in a burgeoning new village near Chatham. Nestling somewhere between Whimpyville and Barratt Platz, I came to the Walderslade Centre, home of the Medway Computer Club.

The club holds its meetings in the offices of B&D Microtronics Ltd., a computer retailer which is run by one of the club members, Paul Cameron. Instead of the usual cacophony of aliens being rent assunder and Pacmen getting indigestion, there was a deathly hush broken only by a voice saying, "Append, Execute" into a microphone attached to a micro.

I was reassured by Paul that this member hadn't finally gone off his rocker after having been exposed to too many disc crashes, he was in fact getting the new Apricot used to his dulcet tones so that it would obey his merest whim without question.

The new Apricot F1 was one of the latest in Paul's stock line and the members seemed to appreciate this

brush with the latest technology even if it was a bit outside their price range.

The club itself owned no hardware but they hope that their limited resources might stretch to setting up a club library this year. This lack of hardware was more than made up for by the members who favoured Sharps, BBC's and Apricots to the more pedestrian machines found at other clubs.

Apparently a Spectrum owner had turned up last year but had clearly felt his machine wasn't up to the competition. This preponderance of up-market machines wasn't due to any snobishness, but due to most members using their micros professionally.

A modem project has been very popular with club members over the past year. No longer content with talking amongst themselves, they have decided to convert the modems to the V21 standard. This will allow them access to a whole range of databases, including Your Computer's very own Telsoft. So a few evenings messing around with oscilloscopes lies ahead.

The club has regular lectures by its

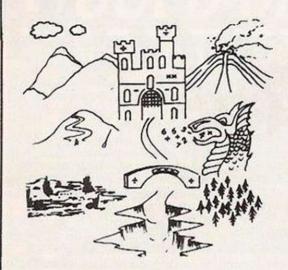
members on various aspects of computing. Lectures about various languages and software such as Lotus 1-2-3 are planned.

Les Mason, club secretary and treasurer expressed his opinion about The Last One, which he had been trying out on his Apricot. The Last One is supposed to be a program writer. You follow a menu-driven process of selecting routines to execute the flowchart you have written. "It takes so long to run, and there are only so many cups of coffee you want to go and make during an evening. And even when it has finished you still end up with syntax errors in the compiled code." Perhaps it should be renamed "At Last, one that works". Les was thinking of following the example of another club member who had successfully taken Apricot to court over the program.

So if you are seriously into computers or feel your mission in life is to show these misguided people that games are really great fun, then you should get in touch with Paul Cameron on 0634 63036. The club meets once a week, alternately on Tuesdays and Wednesdays.



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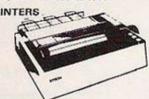
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Fireflash

Oric 1/Atmos No man's land Shoot-'em-up

A promising hi-res blackand-white from this French company. At the top of the screen, le radar représente les vaisseaux hostiles, and vou manoeuvre around à la Defender to shoot the UFOs down. Keys are a little tricky on the Atmos, but would be fine on the Oric 1. Stirring electronic fanfare and competent sound effects. Don't see much Oric stuff from UK companies these days, so looks like the French will cash in on a neglected user base.

Star Avenger Amstrad CPC-464

£8 95 Kuma Shoot-'em-up

* * * A really good Defenderinspired game for the Amstrad, worth comparing at least for ingenuity, with English Software's Airstrike II for the Atari. You have 10 scenarios to choose from: planet, cavern, tunnel, fireballs, bats, aeroplanes, city, maze, fortress and forcefields.

The maze is a really tortuous chequerboard affair which will certainly require you to use your retros as much as anything else - this is the only way the really mean right-angle turns can be negotiated. The aeroplanes are good, too; kamikaze-like, they speed up as they approach you in a last-ditch attempt to terminate your mission.

Osprey BBC B £6.50 BES

Ecological

This program educates people about the plight of ospreys attempting to breed in Northern Scotland. Your job is to deploy your wardens to try to keep people away from the next site, but at the same time, keep the public aware of ospreys. Lots of interesting accompanying blurb.

art 505

Boulder Dash

£8.95 Statesoft

STATESOFT may be cashing in on Reagan's "new patriotism' by proclaiming themselves as American, big, bold and beautiful but Your Computer is quite happy to ignore this sort of vain blustering if the game itself is quite good, which Boulder Dash certainly is.

An enhanced Dig-Dug descendant - or transscendent, as some of the more excitable staff in our office would have it, Boulder Dash puts you in control of Rockford. This feisty little guy is really the star of the show. If you don't get him moving around the screen quickly, he starts tapping his foot and looking peeved. This is pretty dumb of him actually, since as soon as he does move, he is liable to be crushed to death.

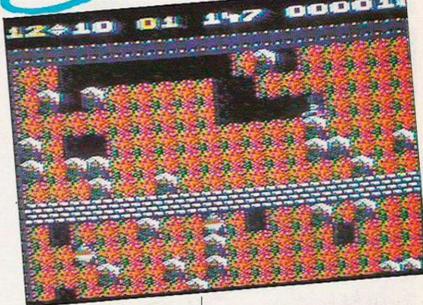
There are 16 mystical caves and five levels of difficulty. Some of the screens can be accessed directly without working through lower levels if there's an aspect of the game that particularly appeals to you.

On the first screen you start by tunneling around, grabbing all the flashing tokens on the screen and exiting to another screen within the time limit. Of course if you tunnel under a rock it will fall on you and kill you. In certain positions it is possible to start a landslide so that you, or rather Rockford, gets killed by a rock you may not have allowed for.

A rather American aspect of the game is that you should manipulate your enemies to ensure their downfall and the aggrandisement of your own personal wealth.

On one of the screens you have to play off a bunch of deadly subterranean butterflies against a relentlessly spreading green amoeba. Your puppet Rockford has to dig a hole to release the butterflies from their cavern and lead them to the amoeba without being killed. When the amoeba and the butterflies make contact, they turn into jewles for Rockford to collect. He can also turn the lethal lepidopterae into lucrative lapis lazuli by dropping rocks on them. Once Rockford has accrued enough crystal the magic escape tunnel appears, permitting him to escape to another zone.

Each level requires the development of new tactics in order to achieve high score, but play at all levels is rewarding and absorbing, rather than just plain awkward - in other words, this game has got playability and is worth the somewhat high price.



Robot **CBM-64**

£8.95 Beyond Software

POWER PILL grid, grab the pills; go left or right on the treadmills, bounce higher on the trampolines, mind the robot-hating alienfire and immunise yourself against them with energiser tokens. A platform game with a nice interactive difference: you can, should you be so minded, design your own Robo-test by pressing the F5 key. In designer mode, the screen puts up a small white cursor which you control by joystick.

You move the cursor down to select components as displayed at the bottom of the screen. You move the cursor over the component to be included in the game, be it treadmill, power pill (see above) and press the fire button. Move the cursor up on to the screen, press the fire button again and move the cursor to paint the. object on screen.

There is a test facility which means

you can check if the game is playable, but still go back and edit anything you don't like without scrapping the game altogether. You can also save your designs to tape or disc.

So the program is a kind of specialised, dedicated, even, games designer. The stock graphics are excellent. It is a great idea for cheats because you can shove hundreds of energisers on screen and only one alienfire.

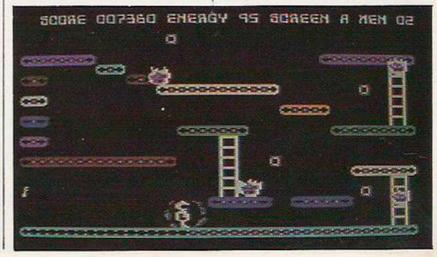
In the main game your robot begins the Robo-test with five lives, one of which is lost every time he makes a mistake. During the Robotest you will see bonus robot tokens which give you additional lives.

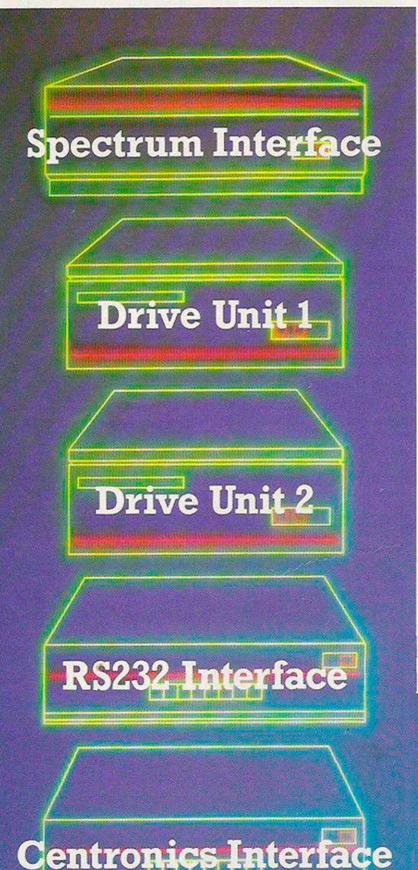
Boxer

BBC £9.95 Acornsoft *

BOXER IS an arcade/platform style game which owes much to the inspiration of the Popeye game and its various imitators.

(continued on page 61)





Spectrum owners! Imagine what great use you could make of all these components. Rotronics have integrated them all into one attractively styled, compact unit. All the power and convenience of floppy disk can now be yours, but at a fraction of the cost.

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Wafadrive is extremely versatile. Five major components are housed within this one unitthe micro interface, two 128K drives, RS232 serial and Centronics parallel ports. Also included in the package are a blank wafer and Spectral Writer-a superb word processor program. The micro interface forms the nerve centre of Wafadrive, controlling all its major functions. The dual drive configuration and the ability to connect standard peripherals directly provides professional system flexibility. All this without a mass of separate components and vulnerable cables. Wafadrive transforms your Spectrum into a very powerful system.

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Data transfer rate is approximately 2K per second. Access time is proportional to capacity. 16K wafers are ideal for program development, with the larger capacity wafers being more suitable for general use and archiving of completed programs and data. Mechanical longevity is assured by the use of high grade materials throughout and full interchangeability between machines is guaranteed.

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Wafadrive provides intelligent file handling and rapid access to data. Program development and other applications can be performed with ease. Start word processing immediately with the specially developed software package included with Wafadrive. Or battle with a spectacular interactive games program. Whatever your mood, you'll find the sophisticated Wafadrive software challenging and rewarding. Future versions of Wafadrive will be available for most popular home micros, so software back-up will be comprehensive.

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Available from all Spectrum dealers, Grattan catalogue and SMT mail order. Trade enquiries: Micro Dealer (UK) Ltd., 29 Burrowfield, Welwyn Garden City, Herts. Tel: (07073) 28181.





WYCOMBE ROAD, HIGH WYCOMBE, BUCKS. HP11 2LB TEL: (0494) 452757

The Magic Roundabout

48K Spectrum £6.95 CRL

Twee little game in which Dougal must build a house before it is time for bed. He does this by pushing sugar lumps around and occasionally eating them to keep his strength up. Dylan the Rabbit and the other magic garden types hurt Dougal's nose if he bumps into them. Good idea, but could have been implemented much better.

Eureka

C64, Spectrum 48K £15.50 Domark Adventure

Mammoth graphics adventure taking you from pre-historic times to the present day; five adventures plus five arcades which increase your strength for the adventures. Using clues in the adventures and the booklet illustrations, you must find clues to a phone number. The first person to ring the number wins £25,000, Good graphics, tortuous plots, even by adventure standards.

Country Cottages

Amstrad CPC-464 £8.95 Kuma Bleed-'em-dry

Corpulent, dark and neat, Miss Wisbanger aged 24 with two children and two dogs, far from being a character in a Margaret Drabble novel is just one of a coruscating host of interesting types you will encounter in this landlord simulation. Draws pretty pictures of cottages, you and your competitors decide on purchase, rent, and tenants.

The pictures are rather nice and the people whether enormous, hairy and rather nervous, or tubby, rosy, and rather shy, are amusing.

(continued from page 59)

Our hero is in the gym preparing for the big fight. Unfortunately his mind has turned to other things; a young lady has entered the gym and is busy chucking balloons around. Old Meat-head here reckons that the way to any girl's heart is through her balloons, and goes about the mindless task of gathering up the balloons as they get stuck in the rafters. So far, so easy. Unfortunately for our man with the cauliflower ears, someone else has got the same idea.

Our friend here also seems to have a glass chin, so any fisticuffs with the

lurbo 64

CBM-64 £7.95

Limbic Systems

THE FIRST HURDLE that confronts you in this game is the ingenious software protection. When the program has loaded, the computer asks you to indicate - by pressing the joystick at the right moment certain colours as they are flashed up on the screen. When four colours have been entered correctly the check is complete and you are into the game.

Like Jet Set Willy the colours come on a grid-referenced chart. The computer gives you two co-ordinates, so you can locate the squares using a "simple" grid reference system. Unfortunately, the documentation omits to tell you which is the top and which is the side of the colour chart. Whilst the numbers on one side stretch down to 83, and the figures on the other side go only to 54, the example given on the documentation uses 5 and 7; these numbers occur on both sides of the grid and consequently can be read in two different ways. Pretty stupid, huh? We could tell you which is the top and which is the side, of course, but why should we do all the work for you?

It's a fast-load program, but not that fast, and having loaded it, it's probably going to take you at least

Microgo 1

Edge Computers

Go is a board game that is at least as old as chess and, arguably, even more demanding.

The rules of the game are extremely simple. Two players alternately place black or white stones on the intersections of a 19 by 19 grid. The idea is to cordon off as much territory as possible. As enemy pieces can be surrounded and lifted off it also a battle for the life and death of groups of stones.

So far it has proved almost impossible to program computers to play a decent game.

Edge Computers' program settles for a mini-version of the game played on a nine by nine board. Even so it plays a rather poor game. One of its most irritating features is that the program has no taste for the Go equivalent of hand-to-hand fighting: after

rival are rather one-sided. Rather unsportingly, his rival is also slinging the equipment around. Various gloves, dumb-bells and hammers fly around and must be jumped,

punched or dodged.

Good graphics and nice presentation fail to disguise a rather thin underlying plot, of rather limited appeal.

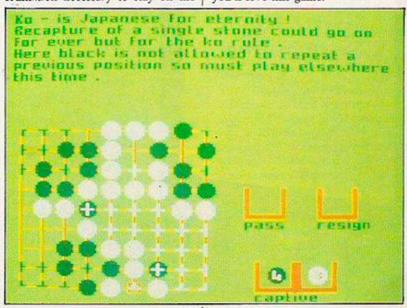


eight minutes to battle through the software protection, bringing you up to the usual 16 minutes of fottling about before you can start playing.

The screen, when you finally get to see it, shows the traditional ribbon of tarmac stretching off to the horizon so beloved of Atari Pole Position racers. Instruments include rpm, mph and you can see the steering wheel revolving.

You have two circuits to choose from, and you can select manual or automatic gear control. Driving along the racetrack is very demanding since it is all too easy to oversteer. I would hazard that the addictive element of this game lies in being able to drive faster and faster as you gradually develop the coordination necessary to stay on the

This is potentially very exhilarating, rather like getting the M1 closed so you can zoom down it at top speed in your DeLorean without worrying about traffic. And whilst excellently implemented in all other respects, I would also hazard that the thing about motor racing is that you compete against other cars, as in the exciting scene depicted on the cassette cover which shows two powerful vehicles haring down the track at near-supersonic speeds. In fact, there are no cars to compete against. It just goes to show what a good job Atari did with Pole Position. If you're the sort of person who enjoys driving along the autobahn at three o'clock in the morning, you'll love this game.



establishing the skeleton of a good position it passes for several moves. It is easy enough then to dart in and snap up the computer's territory.

This reviewer - a mediocre player ranked 12kyu - was able to trounce the computer at the highest level, giving it a handicap of five stones.



The crystal ball

The Sorcerer of Claymorgue Castle from Adventure International is the latest from Scott Adams. You play Beanwick, an apprentice wizard; not only do you have the usual range of Scott Adams puzzles to contend with but must also learn how to cast spells. A sure-fire

Modesty almost forbids me from mentioning two new books. Entitled "The **BBC Micro Adventurer**" and "The Commodore 64 Micro Adventurer", they are complete guides (solutions and maps) to four popular adventures. The BBC version covers Philosopher's Quest, Castle of Riddles, The Count and Voodoo Castle while the 64 version covers these last two plus Lords of Time and Heroes of Karn. Published by Duckworths at £3.95, they are in your shops now.

Century Software are releasing Legend, an adventure and strategy game for the Spectrum. It has animated graphics and over 120K of compressed

A helping hand

For players of Scott Adams Adventureland comes the following succour. If you're stuck in the bog with the blue ox statue, look below.

Something too heavy? "NOYNUB" YAS :XO DNA EXA EHT YLNO YRRAC Still stuck?

TUO MIWS OT EVAH UOY Blade of Blackpool owners, help is nigh.

Flummoxed by the quicksand? HTRON RO TSEW TSAE MIWS

Man-eating plant a problem?

SEEB EHT TI EVIG Yours in swamp and

sorrow. **HUGO NORTH** Our man with the

brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

Flight from the Dark

48K Spectrum £8.95

Five Ways Software

BASED ON the Popular Lone Wolf role-playing books comes a new series of adventure programs. The first two are Flight From The Dark and Fire On The Water. They are superb.

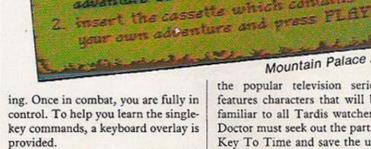
The games are a mixture of beautifully presented text and graphics, the latter being cleverly animated. Each adventure starts in the same way: you train as a Kai Lord to develop fighting prowess and endurance before setting out on your quest. As you progress through the adventure, you are able to call upon, learn about and develop many other Kai Disciplines. These special abilities include sixth sense, healing, tracking, weapon skill, animal kinship, telekinesis, mindshield and mindblast.

In Flight From The Dark, your mission is to wreak vengeance on the Darklords for the massacre of the Kai Warriors. You are the last of the Kai you are now the Lone Wolf.

During your journey, you will be able to use any weapon you find or may choose to fight with your bare hands. Once in combat, a number of movements are at your disposal. You can step forwards or backwards, chop, swipe, thrust, parry and use your mindshield and mindblast powers. If all else fails, you can always run away!

The screen display, magnificently framed and looking like a parchment, is divided into two, the top half showing an imaginative and colourful scene, the bottom half being used as a scrolling text area.

Commands are given by selecting an option from one of several given at each stage. Lone Wolf, whom you guide through the adventure, is an impressively animated cloaked figure. When he leaves one scene and enters another, you may select from the options as soon as he stops walk-



When the program has loaded:

insert the cassette which contains

press BREAK to begin a new

The game comes complete with the paperback, although the latter is not essential for playing the game. However, the book does contain greater detail. To assist you, the program provides the scene reference number so you can look it up in the book if you wish. A great idea and extremely well implemented, the scene number appearing in the head of a bull to one side of the screen.

A great deal of thought and professionalism has gone into the making of these games. For example, as well as being able to save the game at any one of many stages - a cassette symbol always appears as a reminder - you can also save and transfer your Lone Wolf character from one game to another in the series.

While the books are very entertaining in their own right, the programs are even better. Everything about these games reeks of quality, from the presentation of the text to the excellent graphics, from the clarity of the instructions and cassette inlay right down to the provision of an overlay. Super stuff - can't wait for the next ones!

The Key to

48K Spectrum £5.95 Lumpsoft

DR. WHO ADDICTS will welcome this Quilled adventure from quirkily named Lumpsoft - the logo is the 'uneven road ahead' sign.

This textual quest centres around

Mountain Palace Adventure. the popular television series and features characters that will be well familiar to all Tardis watchers. The Doctor must seek out the parts of the Key To Time and save the universe a trivial task, eh? There are plenty of puzzles and the adventure has a good cohesive feel to it. The vocabulary is quite comprehensive and response time is fast.

Hint facilities are built into the program — typing "Help object" may reveal a clue for that specific item. Good humoured and attractively presented, TKTT is certainly worth your consideration. Their next release sounds even more interesting - it's called Malice In Wonderland!

Mountain Palace Adventure

Commodore 64 £7.95

Duckworth

TEXT ONLY, Mountain Palace Adventure offers a more traditional mission. You have heard rumours of vast wealth to be gained by anyone bold enough to penetrate the sinister Mountain Palace. Naturally, being both curious and greedy, you set out to acquire some of this lolly.

There are some strange inhabitants in the Palace. A headless ghost will cause you no end of trouble but if you are unfortunate enough to be killed, the game thoughtfully allows you to be brought back to life in the same spot where you met your end.

Some of the objects you find are stranger still. For example, what use will you make of a spinning top, a fishing rod and an old bone? A jolly romp in the classic mould.



I ENTHUSIASTICALLY ran all this software on our shiny new ZX Spectrum with the real "professional" keyboard. It's not clear exactly what is meant by a professional keyboard but maybe it's something to do with the high drop-out rate in demanding professional vocations, because the keys certainly like to drop out of this machine. So you can imagine it was with some trepidation that I tackled the ancient art of Kung Fu with the aid of my trusty Sinclair. Kung Fu is normally only practised by micro owners when they have carefully explored all the other methods of getting a program to run.

Bug-Byte's delightful program mirrors perfectly the balletic movements of this martial art. Two figures sketched in white against a blue background do battle in a Chinese room. The computer can be your opponent or you can play a friend without discovering how readily his or her teeth fall out. By pressing keys 1-4 you can get your man to kick, chop and punch his way across the screen. There is a nice touch of the Jimmy Hills, too - I don't mean the characters' beards; you can have an action replay of the moves leading to a fall. Nice one Bug-Byte: who knows, perhaps they'll bring out games that take you all the way through Hsing I, Pa-kwa, all the way up to T'ai-chi.

Aggressive foreign types also feature in another Bug-Byte release, Turmoil. Oil is what it's all about: this is a platform in which you have to steer Mic the mechanic around the screen, grab a jug, catch drops of oil from a dripping tank, and refuel the car "before it's too late". Meanwhile, shake the sheikhs' intent on slicing you into shish-kebab with their shimmering swords.

Good fun, 26 levels, but in the final analysis, it's just another platform game. And when I loaded up ESP's Moonlight Magic, dear reader, you can imagine how depressed I was to discover that that was just another platform game, too. Particularly since the cassette inlay had beguiled me with words like "entirely NEW arcade game".

You must climb the ladders and walk the scaffold, avoiding the ghosts and ghouls that haunt the house. Fill your brush from the paint pot and paint the house "before it's too late." Yeah, well. It stars Mack the Brush, but I was tempted to give it the brush-off.

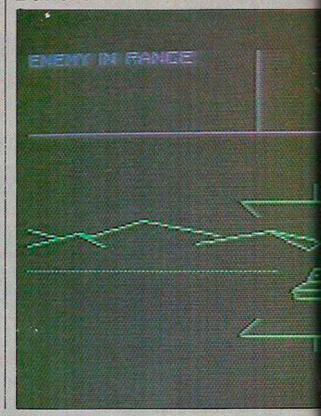
SPECTRUN SOFTWAR SURVEY

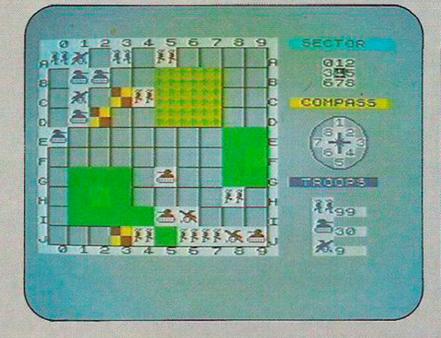
ESP redeemed themselves somewhat in my eyes, and no doubt in the eyes of He who watches over the impecunious but gullible software purchaser, with an interesting game with a Biblical slant. In Noah, it is the last three of those days which can safely be described as antediluvian. Yes, three days before the flood, and you've got to find 31 pairs of animals hidden within 256 screens.

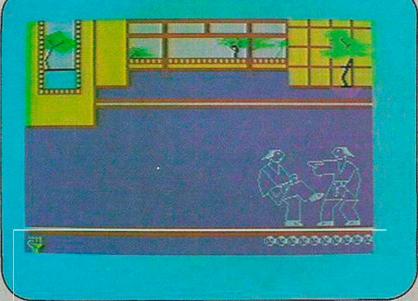
Noah is sketched in black and looks like he just came off the Sunday school wall, crook and all. Shepherd's crook, that is. You have to eat food — shepherd's pie? — to get the strength to move onto the next screen. Dodge puddles, rivers and rocks thrown by the unbelieving populace. You can call up a map which shows your location in the game and the number of lives left.

There is plenty of ground to cover from the badlands to the monster maze and, natch, the caves. The animals are particularly well drawn, though where the descendants of the two giant beavers that I rescued are hanging out today is a secret between them and their maker.

Right: Battlezone from Quicksilva. Below from left to right: War Zone from CCS, Kung Fu from Bug-Byte, Stagecoach from Creative Sparks and Turmoil from Bug-Byte. Paul Bond dies in a shoot out with the Wild Bunch.



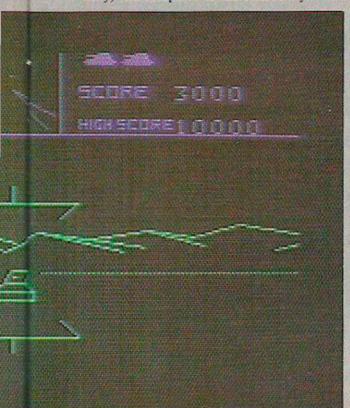




Noah's rescue job might have been easier if he'd found a helicopter. Omega, those nice people who bring you other people's old software at rock-bottom prices have got hold of CRL's Copta and released it as Chopper. It doesn't bear too much resemblance to the Choplifter archetype — no sideways scrolling — but you can rescue your buddies while taking potshots at passing enemy eggbeaters and jets. A good value, shoot'em-up.

War drags on in a Quicksilva implementation of that old Atari favourite, Battlezone, by Bill Witts. The screen has a section at the top which warns you when the enemy is in range, a radar plot of objects in your sector and a high-score. You're driving a tank, of course, and squinting through the fire slit at the truly incredible, given the limitations of the machine, 3-D display showing hostile vehicles built out of matchsticks whose one aim is to see you don't live till chow time.

Nice touches like the individual control of caterpillar tracks make this a must for anyone thinking of buying a tank. Tanks and other material feature in CCS's War Zone, which sounds like it ought to be a song recorded by the Vibrators, or something. You're the Blue Army, the computer is the Red Army — no



Russian dancing or choruses of Kataschok here, however. The screen displays a 10 by 10 grid which is one of nine sectors of the war zone. The right-hand side of the screen displays a nine by nine grid, with the area you are looking at clearly indicated. Below this is a reminder of which keys to move forces in any direction.

The computer has first move; this is a little disconcerting to the first-time user, especially as it seems to go on for so long. But in war the waiting is the worst part. Finally the computer puts up "Command" on the screen which means you can have a go. In this mode there are eight commands you can use, counting saving the game, ending the go or just giving up altogether.

If you're firing from square G7 to square G9, you type in FG7G9 and wait for the result. If you want to move from G7 you type in MG7 and the computer tells you how many squares you can move. You then input the moves using numbers corresponding to the compass rose on the right hand side of the screen. To end your move you can call in an airstrike.

Purple and blue stagecoach

Airstrikes were the least of a cowboy's problems in the Old West. Stagecoach from Creative Sparks claims to be all thundering hooves and Indians and I imagine a thundering Indian would be pretty frightening. Written not by J T Edson but by J T Harris, the game gives you a keyboard definition option, but some of the other de luxe functions like quitting the game, and displaying the score, don't work as indicated in the cassette inlay.

The game is divided into three sections, the Jump, the Mountains, and the Indians. The driver of the stagecoach has been shot and you must get on board. This is the Jump. The screen displays a yellow desert, green cacti, and a purple and blue stagecoach — typical Californian colour scheme. You must gallop up behind the stagecoach, using the keyboard — or joystick — to control your horse. Press fire to jump and hopefully you're on board before all six passengers fall out.

If not, the game ends. Once in control you must collect any passengers who parted company with the coach. Then off to the mountains. As you drive the stagecoach through the mountain passes you have to dodge rockfalls

— I thought these were flocks of birds at first. Occasionally you see boxes of gold or ammunition on the ground which are collected by steering over them.

Finally, the Indians. They try to ride one each side and one in front while a fourth kidnaps the passengers. Bit more lively than the old National Bus Company, eh? The Wild Bunch is an offering from Firebird, one of British Telecom's little money spinners, doubtless of great interest to the greatly-reduced number of the British public who have actually been silly enough to pay money for shares in something that they already owned anyway.

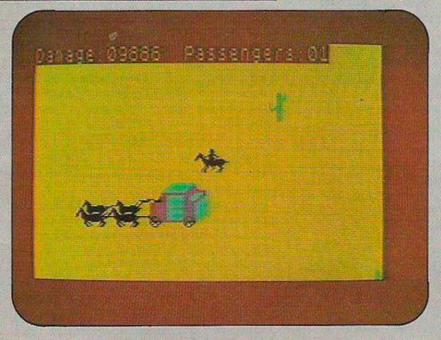
This is really a very good game and bodes well for the project. The covering letter with this software had a touching reference to problems with loading and bugs in some of the games "due to our software protection systems". How true, how true. We get quite a few commercial games that have been protected from being played, let alone copied. No problems with this one, however.

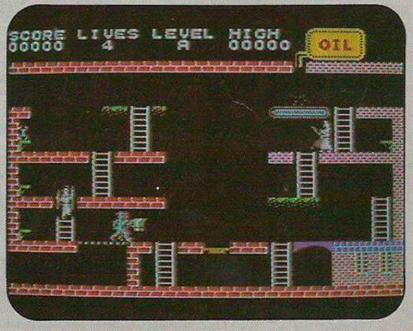
It is a prompted text adventure with some graphics in the style of Automata's Groucho. It plays "Do not forsake me oh my darling" and greets you cordially: "Howdy, pardner! What name do you go by?"

Written by Kevin Smith — not a name you would associate immediately with the days of gunfighters and outlaws — the scenario has you implicated as a man's killer. Your only chance to prove your innocence is to find the real killer, a member of the dreaded Wild Bunch.

You can call up a map of five towns from Dodge City to Dry Gulch as places to hunt down the Wild Bunch. You get your first ride for free, but on second journey from Dodge City to Nugget City, I was attacked several times, using up my strength points. Charged by a cruel, desperate buffalo, you can run, fight or bribe. Have you ever tried bribing a buffalo? The computer doesn't allow it. I offered a Red Indian a bribe, too, but he was so disgusted he took my Colt 45.

This led to my demise in the end because I later called out a man with a patch on his left eye. The screen showed the mean hombré going for his gun, I punched the keyboard—nothing happened. Then the screen put up the message: "You went to the great ranch in the sky—you didn't have a gun!"







A MODEM LINK to the telephone network opens up many possibilities for computer users ranging from access to simple bulletin boards through a variety of user-to-user communications, including electronic mail, to the use of complex interactive databases such as Prestel. This article introduces Telsoft, a new software package which offers a number of additional facilities.

These include a quality program for communicating between home computers, and a totally new method of downloading software which is specifically designed to transmit single programs to many users simultaneously using low cost hardware.

The idea for the Telsoft downloading service came from one of the many Your Computer users who find it increasingly difficult to type in accurately the listings of published programs as their quality, and hence complexity, increases. As the package was developed, it rapidly became evident that there was also a need for a compatible computer communications package, particularly for working with 1200/1200 bit/s half duplex modems where information only flows one way at a time, and in consequence the scope of Telsoft was extended.

The Telsoft program downloading facility is being trailed by Your Computer magazine with both hardware and software support from British Telecom — BT. The service will be provided initially by downloading selected programs for the BBC and Sinclair Spectrum computers from listings published in Your Computer magazine.

The "receive" section of the BBC and Spectrum Telsoft packages are published in this issue of *Your Computer* so that readers with the appropriate computers and modems can try the service out now.

The full Telsoft communication package will also be available in due course from the downloading service. It is hoped that many readers will try out the total package in order to determine the reliability of the computer — computer "Chat" and "Data Transfer" modes



as well as that of the downloading service.

The purpose of the trials is to determine the reliability of the protocols adopted to detect and subsequently correct the vast majority of errors that may arise during downloading or data transfer between computers. However, the error checking procedures adopted in the software developed to date have had to be kept relatively simple in order to minimise the length of the programs.

While programs that will be available on the downloading service will be advised in the magazine — with appropriate instructions to Save and Run the software, it will also be necessary for anyone intending to download software to know on which days particular programs will be available. This information will be given on new BT Audio Recorded Information Service, which will be known as Microline, and which will initially be available on Colchester (0206) 8068.

This will obviously be a speech-only service and will advise micro users on a range of BT computer services, will give details of the telephone numbers of the *Your Computer* 300 bit/s and 1200 bit/s downloading services, and the programs available on this service and will also give advice on how to procure a modem for your computer.

The early stages of developing software for the BBC, Spectrum and Commodore 64 computers have revealed a number of difficult compatibility problems between modems and computers and it has only been possible to test

out the software with specific equipments. As part of the ongoing development we will be looking to all *Your Computer* readers who are programming experts to try out this software, to advise us of any bugs and, hopefully, to suggest the modifications necessary to overcome any compatibility problems.

To date, the software has been trialled with the OE Ltd Telemod 2 modem, working to BBC and Commodore computers, and the VTX5000, working to the Spectrum. These are both 1200/75; 1200/1200 bit/s — half duplex — modems, but the BBC software has also been tested successfully with a range of 300 bit/s modems.

The range of Telsoft programs that have been developed for the BBC, Spectrum and Commodore computers all have the same protocols and menu displays. Full details of the chat, transfer and receive modes are as follows:

Chat mode: This mode allows for a conversation between the two users so that anything either end types appears on both screens. Since either end can type at any time automatic carriage returns are generated when necessary to prevent text from both ends appearing on the same screen line.

Audible warning — typewriter bell — is given when only six characters remain on the current screen line. The delete key still works, although only on the current screen line so if you make a mistake and type onto the next line before noticing you won't be able to erase it.

The BBC is in Mode 7 during Chat mode, which gives access to seven colours and all the Teletext graphics. To obtain all these features, use the function and cursor keys, both with and without Shift.

When you want to leave Chat mode simply press Ctrl — or Symbol Shift — and G simultaneously. An audible tone is given and the Telsoft program reverts to its main menu. This is repeated at the distant end so that neither end gets lost.

Transfer mode: This mode involves copying an area of memory from one computer to another. The information being sent can be a Basic program, some machine code, a data file or even all three. The only restriction is that the screen itself cannot be copied as the Telsoft program writes on screen during the transfer. Naturally, two software procedures are required - one to transmit and one to receive the information; this section describes the general principles and procedures adopted, whilst the following two sections explain the receive and transmit procedures.

The Telsoft program transmits data in blocks of up to 256 bytes, together with a 26-byte (continued on page 69)

```
120 X$= MID$(B$, 2+N+1,1): GOSUB 300

130 IF E=1 THEN 260

140 X$= MID$(B$, 2+N+2,1): GOSUB 300

150 IF E=1 THEN 260

160 B= EVAL("&"+MID$(B$, 2+N+1,2))
                                                                                                 290 END

300 E=0:IF ASC(X$)(48 THEN E=1:RETURN

310 IF ASC(X$)(58 THEN RETURN

320 IF ASC(X$)(65 THEN E=1:RETURN

330 IF ASC(X$))71 THEN E=1
                                                      ?A=B:A=A+1:T=T+B
                                                                                                 340 RETURN
Figure 2.
                                     6860 : A915A20120F4FF20, 394
                                                                         6CC8 :6DA01720156DC941, 2D0
                                                                                                              6E30 :857C867D847EA991,440
6A00 : A9C8A0FEA20120F4, 4C6
                                     6868 :F768A471C888B985,505
                                                                         6CD0 :F00BC942F011C943,413
6CD8 :F0174C616CA907A2,372
                                                                                                                    : A20120F4FFA903A2, 404
                                                                                                              6E38
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6A28
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6A48 :0C20E3FF20F76BA9,439
6A50 :15A20120F4FFA080,3EB
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6A60 : A915A20120F4FF20, 394
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                                                                                                              6FØ8
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:582@E3FF2@E7FF4C,4AC
6AD8
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6AE8
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                                                                         EDFØ
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                                                                         6E00 :867DAAA92020E3FF,478
6E08 :CAD0FAA67D60C97F,55F
                                    6098
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6B30
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                                                                                                              6F70
                                                                                                                    :45535320414E5920, 213
                                          :20F4FF4CB76CA908, 433
      :A573A8A90099856F,3F6
                                    6CA8
                                                                               : DØØBA98620F4FFEØ, 4FD
                                                                                                              6F78:48455920464F5220,210
                                                                         6E10
                                          : A20420F4FFE68AA5, 4CE
     :A58AC902D05820D7,419
                                    6CBØ
                                                                                                              6F80 :4D454E550D202020, 1A2
6B48
                                                                         6E18
                                                                               :00F012A97FC920B0,3C3
     :6BA9C82Ø556CA955, 3BB
                                           :7020E3FFA47E20AB, 46B
                                                                               : 0EC90AF00AC90DF0, 3A1
                                                                         6E20
```

Figure 1.

Ø REM HEX CODE LOADER

FOR N=0 TO 7

REM HEX CODE LONDER

CLS: PRINT
INPUT " START ADDRESS (Hex)":A\$

A=EVAL("&"+A\$)

IF A)&6F87 THEN 280

IF A(&2A00 OR A)&6FE7 THEN 20

PRINT ~A" ":
INPUT ":" B\$,C\$

IF LEN(R\$) () 15 THEN 50

IF LEN(8\$) ()16 THEN 50

:20306EA95020556C,298 6CCØ This program is approximately 1400 bytes in length and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape or disc before you Run its When the hex loader program is run the computer will give the prompt "Start address (hex)?" and you should enter 6A00 and press Return.

6B58

The computer will print the start address of the line and then one space followed by a colon - eg: 6A00: - you then have to enter everything after the colon from the relevant line in figure 2 and press Return at the end of each line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder ready to record before starting to type in the machine-code section.

The machine-code program can be loaded and run automatically each time you call the downloading service by entering the command

#6DA90820006E20F8, 2C4

*RUN "DOWNLOAD" (Return) Provided that all of the machine code is correct you will be asked to select the transmit and receive speeds. For the OE Ltd Telemod 2 modem simply select Option C for both. You will now see the Download Menu with three options numbered 1, 4 and 5.

To receive software from Telsoft, the Your Computer downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone numbers to ring for the 300 and 1200 bit/s downloading services.

When a program you want to download is available, make sure your modem is correctly set up and dial up the telephone number appropriate to your modem's speed. When you hear the modem tones switch the modem to line and replace the receiver.

Select Option 1 from the menu -Receive. As each block of data is received the block number and the program title will be displayed, followed

6E28 : 06C907F002A90060, 2D1 by "OK" if there were no errors. Note that the "OK" will be missing from any blocks in which errors are detected and that the downloading program will wait for these blocks to come round again in order to make a second attempt to load.

190 FOR M = 1 TO LEN (CS)

250 A=A-8:GOTO 50 250 PRINT "TYPING ERROR !" 270 A=8*(A DIV 8):GOTO 50

290 END

280 *SAVE "DOWNLOAD" 6A00 6F87

190 FOR H = 1 TO LEN (C\$)
200 X\$=MID\$(C\$, M, 1): GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C\$) THEN 50
240 PRINT "CHECKSUM ERROR!"

When all blocks have been loaded, the "Program loaded OK" message will appear; after which, pressing Ctrl and G will return you to the Telsoft Menu. Then select Option 5 to leave the Telsoft Menu and return to Basic and Save and Run the program as required.

The full communications package will be made available on Telsoft within the next month. This is a longer machinecode program which, in its current form, uses locations 7000 through to 7BDB and contains Chat, Transmit and Receive modes. It can also be used in place of this program when you are downloading future programs from Your Computer service using just the Receive mode, the operating instructions being the same as for this program. Note, however, that the full Telsoft package starts at location 7000 hex, whereas the downloading section contained in this article starts at 6A00.

GHESTIBUSTIERS THE COMPUTER GAME, BY DAVID CRANE



© 1984 COLUMBIA PICTURES

Yes. Ghostbusters is a computer game, too. The game play follows the film with incredible accuracy. Even down to the chart-topping music score.

Your task is to rid the world-and in particular New York City - of a cataclysmic plaque of ectoplasmic nasties.

Play it well and we give you a Ghostbusters franchise with your own secret account number. Use this number and the money it brings you, to buy the same ghost busting gear they had in the film. (Don't worry - we'll give you some money to get started.)

You will have earned it. And you can use it to go to undreamed of levels. Don't try to use someone else's number, we'll find out.

From then on, it's you against the ghosts. All the way to the Temple of Zuul.

Where the final battle begins...

Designed by USA's David "Pitfall II and Decathlon" Crane and running on Commodore 64 cassette and disk and Spectrum. Coming soon on other systems.



Your computer was made for us.

(continued from page 67)

header. To each of these a two-byte error cyclic redundancy - check is added so that errors can be detected and false data ignored. If errors do occur the faulty block is sent again until the distant end confirms that it has been correctly received. The header includes a 16-byte title - provided by the sender - and 10 bytes of control information.

Each block - plus header - is separated from the next by a gap of approximately half a second. This make it possible for faulty blocks to be retransmitted and also for Telsoft to receive a program from an endless-loop transmission starting from any block and continuing until all blocks have been received. This is the method of transmission utilised by the downloading service and the instructions for receiving this format are given in the next section.

Each block in a transmission may be part of a Basic program or part of a machine code or data area. Basic programs are automatically placed by the receiving computer in its own Basic area, which makes it possible for different varieties of the same make of machine to swap programs.

Because machine code may contain instructions to jump to a specific address, this type of block cannot be relocated by the receiving computer and must be placed in the same area of memory that it came from. In this case the

data address is included in the 10 bytes of control information heading each block.

A point to note here is that many Basic (continued on page 71)

```
IF e=1 THEN LET a=a-1: GO TO 260 NEXT m
                                                    110 FOR n=0 TO 7
120 LET x*=b*(2*n+1 TO 2*n+1)
125 GO SUB 300: LET y=x
130 IF e=1 THEN GO TO 260
140 LET x*=b*(2*n+2 TO 2*n+2)
145 GO SUB 300: LET y=y+16+x
150 IF e=1 THEN GO TO 250
170 POKE a.y: LET a=a+1
190 LET t=t+y: NEXT n: LET y=0
190 FOR m=1 TO 3
200 LET x*=b*(17+m TO 17+m)
205 GO SUB 300: LET y=y+16+x

SEBEREFOROMOCDIF, 400: 60550
                                                    110 FOR n=0 TO 7
    REM SPECTRUM 48k #19
REM Hex Code Loader
POKE 23658.8: CLS : PRINT
                                                                                                          250 PRINT "Typing Error"
250 PRINT "Typing Error"
                                                                                                                      THEN PRINT ":"; 68: 60 TO 50
                                                                                                              PRINT "Typing Error
LET a=8*INT (a/8):
SAVE "download"
    INPUT "Start Address ";a
IF a)61135 THEN GO TO 280
IF a(60000 THEN GO TO 20
                                                                                                                    a=8*INT (a/8): GO TO 50
"download"CODE 60000,1136
    PRINT a:
INPUT ":";6$
                                                                                                          280
                                                                                                          290 POKE 23558.0: STOP

300 LET e=0: LET x=CODE x$-48-7*(x$)"9")

310 IF x(0 OR x)15 THEN LET e=1
85 IF B$="END" THEN GO TO 280
90 IF LEN 5$()20 THEN GO TO 260
100 LET t=a-256*INT (a/256)
                                                                                                          320 RETURN
                                                                                                                       60848 : 20FDF1C9CDACED3D, 62A
                                        60272 : ED5B6BEF0E00CD1F, 40C
                                                                               60560
                                                                                        :00C8F53E20CDBBED,520
                                                                                                                       60856 : 20FAC9C5DSE5F5FE, 70D
Figure 2.
                                       60280 : EDDAAAEA3273EFCD, 634
60288 : EBEC3A68EFFE0020, 506
                                                                               60568
                                                                                       :F13DC38FECCDA0EC, 65D
                                                                                                                       60864
60872
                                                                                                                               :7F2813CDF9EDFE0C,537
:280CFE0D20053E20,28A
                                       60288
60000 : CD15EDC307ECCD15, 4C7
                                                                                        : CDA3ECCDA6EC3EØD, 5A6
                                                                               60576
60008 :EDCD36ECCD66EDCD, 631
60016 :BBEDFE31CA99EAFE, 692
                                                : 053A69EFE6803A73, 432
                                       60296
                                                                                        : CDBBED3EFF328C5C, 574
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:2128Ø33EØ8D73E5F,2E6
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60024
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                                                :328D5C32485C3E01,250
                                                                                                                      61024
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60168
        : 11CDEECD1FED389A, 47F
                                       EM45E
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                                                :CD5@EDC366EACD15,52F
                                                                                                                               : 204D454E55003120, 216
        :12130CCDEBEC79FE, 45C
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:28043E3618023E37,187
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60184
       :1020F03A68EFCDB1, 447
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        :ECCD1FEDDAAAEA21,574
                                       60480
                                               :2165EE3EØ8CD8FEC, 442
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60192
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                                               :CD84ECCDA3ECCDA6, 654
                                                                                       :81EFFE0028043E36,376
:D3FFCD50EDF1C93E,644
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        :6FEFBE28133E5811,326
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        :E0EE12133E0012CD, 340
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        : D7ECCDA6ECC3AAEA, 6B1
                                                :CDAØECCD84ECCDA6, 661
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        :EFBE20E121E5EE3A, 524
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60232
                                       60520
                                               :84EC23CDA3EC3E03,498
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                                                                                       :302004DB7FA7C93A, 3E0
                                                                               60808
        :68EF856F3E008C67,3CC
                                               :CD8FECCD84ECC9CD, 68B
                                                                                                                              :7475726E20746F20,39C
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61120
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                                        60536
60248 : 3E00BE200BCDD7EC, 40F
                                               :A3EC3E07CD8FECCD, 561
                                                                                       :18023E36D3FFDB7F,
                                                                               60824
6Ø256 : 3E2132885CC3FFEB, 482
                                                                                                                              : 4E544552204E554D, 309
                                                :84EC23C97EFE00C8,520
                                       60544
                                                                               60832
                                                                                       : C9CD47ED3A73EFD8, 5DE
60264 : 3E00326FEF3270EF, 3C7
                                                :CDBBED23C384ECFE, 651
                                                                               60840 :F10366EAF53ED23D, SEE
                                                                                                                      61128 :424552200000000000, 1C1
                                       60552
```

This program is approximately 1,200 bytes and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape before you Run it. When the hex loader program is run the computer will give the prompt "Start address" and you should enter 60000 and press Return.

The computer will print the start address of the line followed by a colon and the C cursor, you then have to enter everything after the colon from the relevant line in figure 2 and press Enter at the end of each line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder ready to record before starting to type in the machine-code section.

The machine-code program can be loaded by entering the command LOAD "DOWNLOAD" CODE 60000, 1200 (Enter) and then

RANDOMIZE USR 60000

Provided that all of the machine code is correct you will now see the Download Menu with two options numbered 1 and 5. It should be noted that this software has been specifically written for the combination of the Sinclair Spectrum 48K and the OE Ltd VTX 5000 (1200 bit/s) modem. The downloading service will therefore initially only be operated at 1200 bit/s for Spectrum programs, but consideration will be given to a 300 bit/s service should the demand arise.

To receive software from Telsoft, the Your Computer downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone number to ring for the 1200 bit/s downloading services.

When a program you want to download is available follow the instructions under lined on page 67.

When all blocks have been loaded correctly the program will return you to the Telsoft Menu. Then select Option 5 to leave the Telsoft Menu and return to Basic and Save and Run the program as required.

The full communications package will be made available on Telsoft shortly. This is a longer machine-code program which, in its current form, uses locations 61440 through to 64767 and contains Chat, Transmit and Receive modes. It can also be used in place of this program when you are downloading future programs from Your Computer service using just the Receive mode, the operating instructions being the same as for this program. Note, however, that the full Telsoft package starts at location 61440, whereas the downloading section contained in this article starts at 60000.

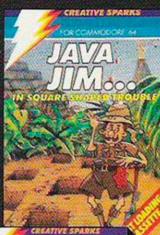
UALITY CONTROL ROM CREATIVE SPARKS

Forthose who demand excellence

JAVA JIM

Guide Java Jim ground the screen digging near square holes as he searches for ancient relics.
You will have to avoid the lumps of sizzling lava being continually showeded down on Jim from the still additional programs in this highly original fun game.

4 full graphic all action screens. 20 levels of play. High score feature. Fast loading cassette.

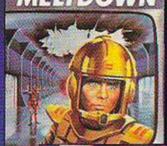


COUNTDOWN TO MELTDOWN

An amazing graphic action adventure game which puts you in charge of a team of androids trying to reach the core of a nuclear reactor before it explodes. This game has over 2000 rooms to be negotiated and every single one of them is in 3D!!

Probably the most exciting game yet developed for the C-64. Fast loading cassette.

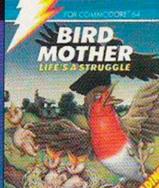
COUNT DOWN TO



BIRD MOTHER

This is a delightfully original game which uses nature as the setting for a highly compelling and challenging game. Guide the Bird Mother as she builds her nest and raises her young, finally protecting them from a predator hawk.

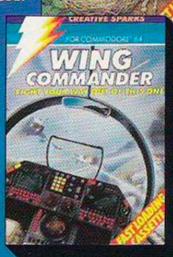
Fast loading cassette. The stunning graphics and music in Bird Mother are not to be missed.



WING COMMANDER

This is a highly sophisticated flight combat simulator which puts you in the pilots seat. Highly advanced machine code programming has ensured you feel every stomach lurching dive and roll.

With 17 separate controls to be monitored and several ground targets to be defended from the attacking enemy bombers. This game will stretch your skills to their limits. Fast loading cassette.



CREATIVE SPARKS

Available from All good computer software stockists.

Send me (tick as required)

- JAVA JIM TNCE163 (C64) £7.95 COUNTDOWN TO MELTDOWN TNCE273 (C64) BIRD MOTHER TNCE263 (C64) WING COMMANDER TNCE203 (C64) £7.95 £7.95 £7.95
- My local stockist's address Your full list of games
- Game/s at £7.95 each + single P&P sum
- p 30p Total to send

Method of payment

By cheque or PO (no cash) made payable

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□ By Access

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Creative Sparks. Department MO, 296 Farnborough Road, Farnborough, Hampshire, GU14 7NF. Telephone: (0252) 518364.

Name

Address

YC1284

(continued from page 69)

programs contain data statements that will be used to create a machine-code routine when the program is actually run. In this case all that need be sent is the Basic program only, since this contains all the necessary information to locate the machine code accurately.

Receive mode: There are two applications for the Receive mode. The first is in conjunction with the previous section - ie: receiving blocks of data from another computer - and the second is in conjunction with the Telsoft downloading facility.

When receiving data from another computer the receive mode is selected by pressing 1 when the main menu is displayed. The screen will clear and then, as each block is received, its block number - in hex - its title and an OK will be displayed. As mentioned before, faulty blocks are automatically repeated, and thus if a very noisy line is encountered and frequent errors are occurring both computer users are aware of the problem. When all blocks have been received correctly, a "program loaded OK" message is displayed and both computers automatically revert to Chat mode.

The same receive software is used to run Your Computer downloading service but in this case, since the program is continually transmitted in a loop 24 hours a day, loading will start at the beginning of the next block number that the computer sees immediately following connection to the service. With a continuously transmitting service there is also no possibility of retransmitting blocks when errors are received, so some other method of error correction has to be adopted.

The method adopted to overcome this problem is as follows; when the received block number reaches the point at which the computer started to load the data, checks are made to see whether any blocks contain errors; if there are none, then the program will stop loading data and return to the main menu.

If, on the other hand, some errors have been received the program will continue to look for, and then load in again, all the individual blocks which were received with errors. Naturally, error-free blocks are not loaded again to avoid any chance of them containing errors the second time round!

Transmit mode: This is selected by pressing 2 when the Telsoft main menu is displayed. The screen will clear and you are prompted "Transmit Basic (Y/N)" to ask if you want to send a Basic program. The computer notes the answer and then asks "Transmit Bytes (Y/N)" to find out whether anything apart from Basic - for example: a machine-code section - is to be sent. If your response is "Y" the computer will then ask "How many areas (1-7)?". Once you have indicated the number of separate areas to send you will be prompted for the first and last address - in hex - for each area.

When this section is complete Telsoft will prompt you for the program title for this transmission, which may have a maximum of 16 characters in it. Transmission then begins automatically and continues until all blocks have been sent and acknowledged as being correctly received. As each block is sent the block number - in hex - is displayed, together with a + for each 16 bytes sent and a final OK when acknowledged. When all the blocks have been



sent Telsoft reverts to Chat mode.

If you have received a program from another user, check whether the transmission included any machine code or data areas - apart from Basic - and, if so, make a note of the relevant addresses. Then finish the telephone call, press Ctrl - or Symbol Shift - and G to return to the Telsoft main menu and press 5 to exit to Basic. Then use the normal methods to save on tape or disc as appropriate.

Programs available on Telsoft service: At the time of writing, programs for the BBC model A and B and Spectrum 48K computers have been completed and given limited trials which were successful. A program has also been completed for the Commodore 64 computer but has not been sufficiently tested.

It should be noted that the Telsoft communication programs offered are only compatible with each other and the downloading service. For communication to bulletin boards generally a much simpler range of software is needed and on the other hand communication with Viewdata services such as Prestel requires more complex software.

TRANSFORMS THE HOME COMPUTER

OUT OF ALL RECOGNITION

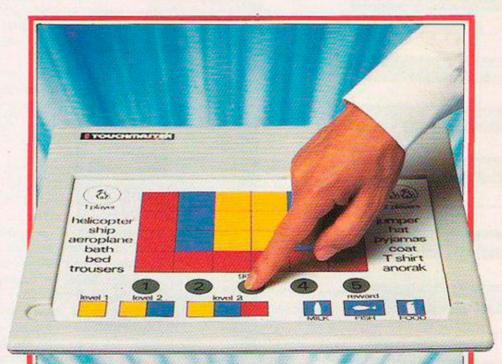
Because Touchmaster is a touch sensitive surface which effectively bypasses the keyboard, it has none of the keyboard's complications, typing skill requirements or potential errors.

To operate Touchmaster, you simply slide an overlay onto its surface, load the matching Touchware into your computer and touch the overlay.

For repeatability and resolution, no other ostensibly comparable pads can touch Touchmaster.

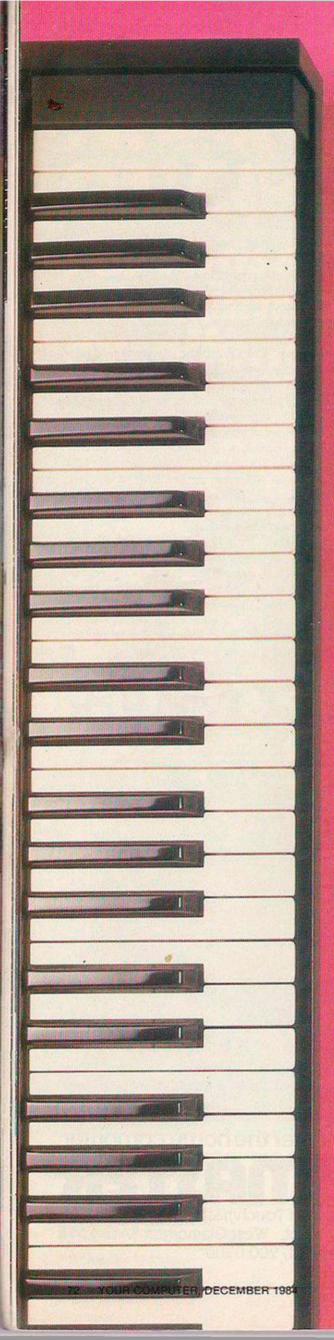
In fact, Touchmaster's unique technology makes it state of the art when it comes to such pads.

Other pads might fairly be described as peripherals. Touchmaster goes a lot further: it respecifies the home computer.



Now anyone can master the home computer

For full details, contact Touchmaster Limited, PO Box 3, Port Talbot, West Glamorgan SA13 1WH, or phone Teledata (01) 200 0200



Is it a computer or is it a synthesiser? Yamaha's CX-5M is an MSX micro with two keyboards. Tony Sacks ran his fingers over both.

1984 HAS BROUGHT the very different worlds of the micro buff and the musician considerably closer. On the micro front, there has been a noticeable increase in the amount and quality of software and hardware designed to make the most of computers' built-in sound making facilities. This is particularly true of micros like the BBC and the Commodore 64 with their relatively sophisticated music chips.

Meanwhile, musicians are beginning to exploit the tremendous possibilities offered by Midi—the Musical Instrument Digital Interface. As described previously—Your Computer, September 1984—Midi is a digital Esperanto which allows various electronic instruments such as synthesisers, sequencers and drum simulators to send digital messages to each other. With suitable interfaces these instruments can also be connected to computers.

Yamaha's CX-5M merges these two worlds in one £449 machine. Superficially it looks like any of the rapidly-growing army of MSX clones. The only sign that it is something special, is the inscription "music computer" next to the model name.

A tour around the crowded perimeter of the computer begins to reveal its dual personality. In addition to the standard MSX sockets for joysticks, Centronics printer and TV and monitor outputs, there is a pair of DIN sockets marked Midi In and Out, two additional stereo sound outputs and a Music Keyboard socket. In all, the machine has more than 180 electrical contacts waiting to communicate with the outside world.

The CX-5M has a professional look and feel emphasised by a sober grey and black colour scheme. The keyboard is pleasant to use, despite a slight wobble on the space-bar. The only oddity is the inclusion of a blank "dead" key used to add various accents to vowels for foreign languages. There is no £ key although the sterling symbol can be accessed from the vast MSX character set using the Code and Shift keys.

Two switches — one on the computer, the other on the substantial power supply — are needed to turn the CX-5M on. If the Rom

cartridge slot is unoccupied the machine tells you that it has 28,815 bytes available from its 32K of RAM. In this mode the computer does everything that you would expect of an MSX machine.

However, type in the command of Call Music and you enter a different world. You now have access to the computer's unique feature — a built-in FM sound synthesiser.

Two music keyboards are available to plug into the socket mentioned above: a miniature 44-note device costing £85; and a full-size 49-note keyboard costing £165. In the MSX Basic mode, these keyboards are lifeless, but once you enter the synthesiser mode, you can use either keyboard to play any pair of sounds from the CX-5's repertoire of 46 pre-defined sounds or "voices".

The keyboard can be "split" at any note along its length so that two different voices can be played on different halves of the keyboard at the same time.

The quality of these sounds is one of the

FM — a natural way to synthesise

The synthesiser in the CX-5M is not an ordinary synthesiser — it's an FM synthesiser.

It uses a different approach to sound synthesis to that used in almost all other synthesisers, including those built into the BBC and Commodore 64 micros.

Most synthesisers are based on a technique known as subtractive synthesis. Simple, but harmonically rich, waveforms such as square waves or sawtooth waves are progressively filtered — to remove or emphasise certain frequencies, modulated, and manipulated in other ways to produce the final sound.

This technique can result in powerful sounds but they invariably have an artificial feel to them. This is because the relative strengths of the various harmonic components remain fixed for the length of each note. In acoustic instruments, this balance changes constantly.

FM synthesis is designed to produce more natural sounds by simulating this process. It does this using a technique



CX-5M's main strengths. They range from powerful simulations of real instruments such as pianos, flutes, guitars and organs to gimmicky sounds such as the "chirping of a small bird" and the "sound of raindrops". At their best — in, for example, the harp and timpani simulations — the sounds are stunning, and even the less convincing voices are not unpleasant.

The quality of the sounds is one immediate difference between the CX-5M and other micros. Another difference is that the Yamaha computer can produce up to eight notes simultaneously, compared to the three of the Commodore 64 or the BBC.

A third difference is the inclusion in the CX-5M of an automatic rhythm section to accompany you while you tinkle away on the ivories. You can select a variety of drum, bass and chord accompaniments to join you as you play. It must be said, however, that the sounds and patterns of this accompaniment are disappointing compared both to the

quality of the main synthesiser voices and to rhythm sections in all but the cheapest portable music keyboards.

If you want to store your musical efforts, there is a Record facility which will remember up to 2,000 notes as you play them. You can then play back the recorded section and accompany yourself on the keyboard at the same time. If you are pleased with the result you can dump it onto a cassette.

Although you can tinker slightly with the 46 standard voices using the firmware, you cannot alter the basic sounds. To make fundamental changes to the voices or to create your own new ones, requires additional software.

Fortunately, Yamaha has produced a Rom cartridge containing this software. Each FM voice is defined by more than 60 inter-related parameters and altering these to achieve a specific effect is not easy. Creating a new voice from scratch is even harder. The FM voicing program is designed to make this task as easy as possible and, in general, it succeeds.

However, considerable practice is needed before you get a feel for how altering any particular parameter will affect the overall sound. The 48-page manual that accompanies the voicing program gives some guidance on how FM synthesis works as well as some examples of how to create new voices.

The FM Voicing Rom is one of four software ROMs, each costing £36, that Yamaha has developed to tie in with the launch of the CX-5M. Perhaps the most interesting of these from the micro enthusiast's point of view is the FM Music.

Macro Rom which extends the MSX Basic with 36 new commands that allow the synthesiser to be controlled from Basic.

The Music Macro permits the playback of eight musical parts using up to four different voices while a Basic program is running. These voices can come either from the standard 46 sounds or from a data cartridge holding new voices produced by the voicing program.

Using the Music Macro cuts the memory available for Basic programs to less than 20K. The number of notes per part is limited to a maximum of around 500 although parts can be chained together if necessary.

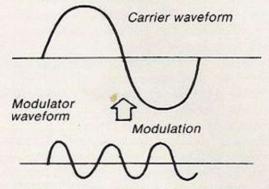
The Music Macro can be used to control other electronic musical instruments including synthesisers and synthetic percussion devices through the Midi link. It also allows the programmer to define patterns for the built-in rhythm section.

The third Rom will probably help to sell the CX-5 more than any of its other attractions. It contains a composer program which allows a musician to write a six-part musical score on the computer screen using conventional musical notation and then to play the music back through the internal synthesiser, or through external instruments via the Midi link, or both.

The notes are entered using either the musical or computer keyboards. In the former case, the notes can be played at any speed — the computer only accepts the pitch information, not the timing.

A particularly attractive aspect of the (continued on next page)

Changes in the waveform caused by FM

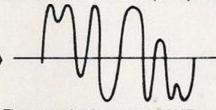


similar to that which produces FM.—
frequency modulation — radio transmissions. Essentially, one simple waveform — the carrier — is modulated by another — the modulator — to produce the natural-sounding output.

This simple idea proved difficult to put into practice. It took Yamaha more than a dozen years to perfect and to squeeze the complex digital circuitry on to LSI chips.

Last year, Yamaha launched the first FM synthesisers that musicians could program to produce their own sounds.

When the waveform is frequency modulated



These synthesisers — the DX-7 and DX-9 — took the music world by storm and now almost every band that uses synthesisers has at least one DX machine. On their recent megatour of the United States, the Jacksons used at least 10 of the £1,300 DX-7s on stage.

The synthesiser in the CX-5M is a slimmed down and modified version of the £900 DX-9.

One of the snags of FM synthesis is that it is more difficult to program new sounds, especially for synthesists used to traditional synthesisers. The Rom cartridge supplied with the CX-5M is designed to make programming of its built-in sounds easier. One of the other Rom cartridges does the same job for the DX-7 using a Midi link between the computer and the synthesiser.

(continued from previous page)

composer program is that it allows conventional musical symbols and expressions for dynamic changes in a composition to be entered along with the notes. These musical instructions are followed by the synthesiser when it regurgitates the music, giving the sounds an eerie, almost human feel.

The program is not, however, perfect. Most of the CX-5M keys are redefined to allow the musical notation to be entered and because the program operates in two different modes, many of the keys have two functions. This can cause confusion as you swop between the two modes. A keyboard overlay or on-screen indication of the redefined keys would ease the confusion, but neither is provided.

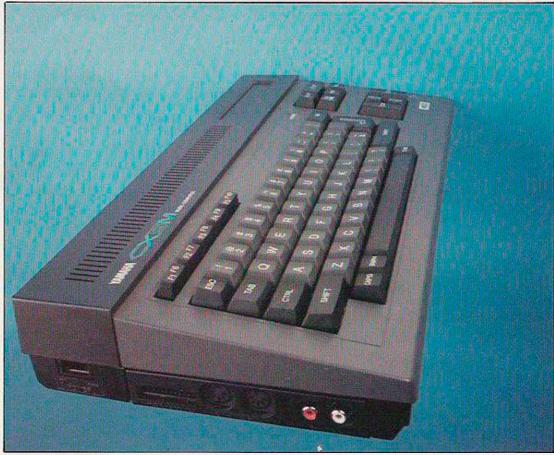
Pixel resolution problems

Other problems arise from the 256 by 192 pixel resolution of the CX-5M's display. This means that only one of the six parts can be shown at any one time and it can become complicated working out how the various parts tie in with each other. The one-part-at-atime limitation also applies to printouts.

The limited screen resolution also means that it can be difficult to distinguish between similar note symbols. And chords have to be displayed confusingly as emaciated notes spread across the stave.

But the many attractions of this program far outweigh these minor difficulties which do not affect the quality of the music it can produce. Regular users of the package will probably soon adapt to its idiosyncrasies.

The final Rom cartridge will only be of interest to owners of Yamaha's DX-7 synthesiser. This instrument can produce even more impressive sounds than the CX-5M but is correspondingly more difficult to program. The cartridge is designed to ease the task by displaying the parameters graphically on the CX-5M screen where they can be edited. Information is exchanged



between the DX-7 and the CX-5M using the

So there we have it. The CX-5M is certainly a computer with a difference. On the whole it is a well thought out machine with a few minor disappointments.

One of these is that the Midi interface built into the CX-5M does not offer full two-way Midi facilities. While it can transmit signals to control external synthesisers, it cannot itself be controlled by other synthesisers.

The lack of a full Midi interface also means that musicians will not be able to use their own Midi instruments to provide a musical input for the CX-5M. Most will probably regard the optional miniature keyboard as

little more than a toy and will have to buy the larger £165 keyboard to make best use of the computer. A full Midi interface could avoid this extra cost.

Despite this, it is easy to see why the machine will appeal to musicians and why there have been waiting lists for it since it made its debut at a music industry exhibition earlier this year. Musicians are used to spending upwards of £600 for a synthesiser, so to get a computer and a Midi interface thrown in at the same price must be a bargain.

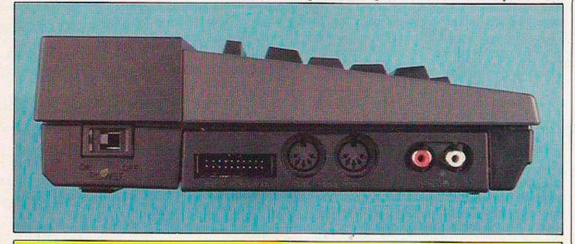
Ironically, the price is also likely to be the main barrier to the machine appealing to a wider audience. You have to be either wealthy or keen on music - or both - to pay more than twice as much for the CX-5M and keyboard as you would for an ordinary MSX machine of a similar specification.

Yamaha planning software

Another factor likely to deter many wouldbe purchasers is that there is unlikely to be much independent software that takes full advantage of the computer's facilities. Companies which do produce software will probably aim their packages at the musician and will charge high prices to cover the limited market for their products.

Yamaha itself is planning further software packages but has not revealed any details. There are, however, several types of program that could widen the appeal of the CX-5M, the most important of these being for education. The CX-5M could provide an excellent tool for teaching music, using onscreen displays and prompts. But this will not happen until the right software becomes available.

On a final, more optimistic note, the prices quoted in this review may be short-lived. The music industry is notorious for substantial retail discounting. As the CX-5M is being distributed mainly through the music trade, the cost-cutting practices may well be applied to it within a few months.

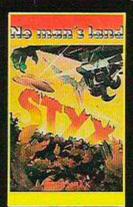


CONCLUSIONS

- ■The CX-5M is the most interesting and original of the MSX mutants to reach the U.K. so far. It is a well designed and well constructed machine.
- The quality of the sounds produced by the CX-5M show the painful limitations of the sound-making capabilities of even the best of other micros.
- At a cost of more than £600 for the computer and the full-size keyboard and £36 for each software package, the CX-5M will appeal mainly to dedicated musicians.
- It seems penny-pinching to provide only 32K or Ram when MSX machines costing well under £300 offer 64K. It will be particularly frustrating to run out of memory as you near the end of your magnum opus.
- ■The CX-5M proves conclusively that micros can be used for more creative purposes than merely zapping aliens, eliminating galaxies, killing dwarves and perfecting take-off and landing procedures.
- ■The CX-5M will probably be the first microcomputer to star on Top of the Pops.



0508 CATEG-ORIC (action game). Take command of a cruiser engaged in battle against fighter planes and submarines. Use the radar and sonar systems to detect and destroy the enemy before you are sunk. & 7.95



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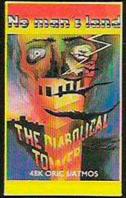
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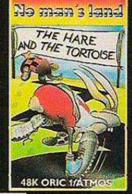
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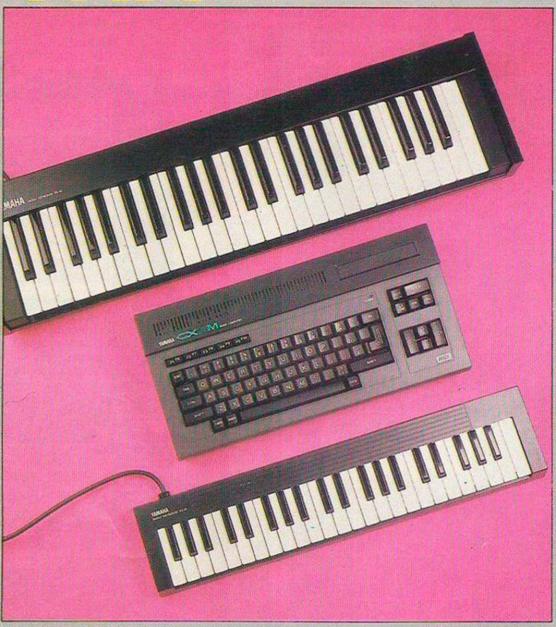
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"There's nothing in this movie that isn't happening in the world today"
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"I will be prepared to sit down and eat one in Trafalgar Square if it's late"
"Business is war"
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UTh

- "Those who operate at the cutting edge of technology shall be sacrified upon it" "I've been making jokes about computers for long enough it's about time I found out a bit more about them'
- "The same technology which brings us the likes of Pac-Man is scaring the hell out of our enemies"
- [5] "Most home computers are current buns: printed circuit board sandwiched between two sheets of cream plastic, with a few keys sticking out of the top"
- "Most people are so pleased when they do manage to copy our programs that they write and tell us. We just warn them not to sell it"

- 1. Douglas Adams, author of The Hitch-hiker's Guide to the Galaxy.
- 2. Hermann Hauser Acorn's technical director.
- 3. Geoff Hollington, designer of the Enterprise's external casing.
- 4. Adam Osborne, founder of the Osborne Corporation.
- 5. William Poel, Amstrad's What would your quotation be?

- software division general manager.
- 6. Mike Radford, director of the film 1984.
- 7. Sir Clive Sinclair, Chairman of Sinclair Research.
- 8. Jack Tramiel, formerly of Commodore, now Atari.
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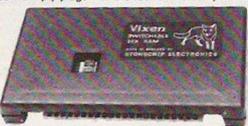
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COMMODORE

OCTOBER'S COMPETITION offered as a prize Commodore's rival to the QL, the new Plus 4. On the entry form we asked you to place eight features in order of importance. You then had to suggest names for both a program that you would like to see on the Plus 4, and the software house that would launch it.

With its built-in software the Plus 4 is clearly intended to be used more for serious applications than games playing. So in picking a winner we favoured those suggestions that reflected the machine's practical nature.

We awarded the prize to Dr W Davidson, Brunswick Health Centre, Hartfield Close, Manchester, whose list of features was the following:

- 1. Value for money
- 2. Professional keyboard
- 3. Database
- 4. Graph display
- 5. Wordprocessor
- 6. Spreadsheet
- 7. 60K user Ram
- 8. Neat wedge styling

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The seventh feature, 60K user Ram, took a higher place in our panel's list. But we were impressed by the winner's program suggestion. Wittily entitled "What Brings You Here" the program would take a GP patient's case history using graphics to pin-point the site of pain, etc.

The idea has already been implemented on larger systems but there is no reason why it should not also be feasible on the Plus 4. Whether patients would — or should — be satisfield with the computer's bedside manner is another matter.

If the competition entries are anything to go by home computer owners are preoccupied with health and fitness. We were surprised by the number of people who would like to see programs for home diagnostics, diet planning, calorie counting, and the like. Software companies take note.

Some of the other practical suggestions were, perhaps, less feasible. The most common was for a program to convert CBM-64 Basic to Plus 4 Basic — a difficult feat since it would involve converting Pokes into graphics commands.

N Smith's Decompiler, on the other hand, probably could be implemented. But what would be the point of a program to translate machine code into Basic?

Ideas for games ranged from the boring to the whacky and bizarre. From J Tant came Flea Destroyer: you start off with "an overall plan of a cat, destroy the fleas with a spray can, then move on to a dog".

We were tickled by J Kingsbury's Highland Fling, a Scottish version of Decathlon, in which

PLUS 4 competition

RESULTS

you participate in events like tossing the caber. Also noteworthy was D Ahearn's game for paranolacs, Stop your Neighbours. The idea here is to prevent your neighbours from encroaching on your property.

In B Gadd's Deadline you would have to produce a monthly computer magazine, collecting features, artwork, letters, and so on, while overcoming such obstacles as strikes, gremlins, ghostly news-hounds, and paper shortage. Sound familar, but not much fun to play.

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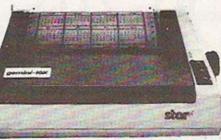
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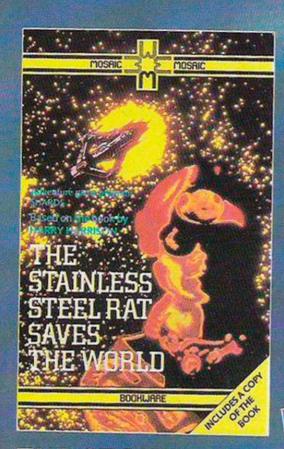
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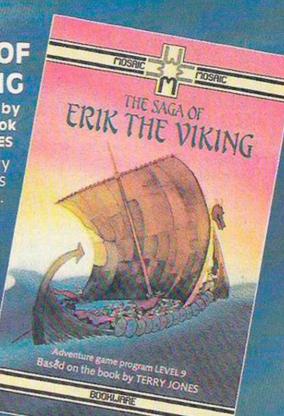
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FROM HERE (TO REALITY)

Today's home computer cave paintings are only 16 million colours away from reality, says screen star Simon Beesley...

ANYONE WHO HAS seen *Tron* will be impressed by the quality of the film's computer graphics. But believable though they are they still fall short of the goal of computer animation which is to simulate reality on screen.

At the London Computer Graphics Conference held recently, Loren Carpenter, staff scientist at Lucasfilm's Computer Division, discussed the exciting possibilities of a computer graphics future in which you will be able to turn your imaginary landscapes into screen reality: "Artists will be able to see their creations move. Filmmakers will feel free to experiment."

But for the moment such scenarios remain the stuff of science fiction. Lucasfilm, for example, is developing what might be described as the next generation of graphics machines, the Pixar 2D and 3D systems. Although more advanced than any current system the Pixar 3D will still take up to two minutes to generate a single realistic movie frame.

Consider the problems involved in creating a convincing 3D perspective image. First you need to define the objects to be displayed in terms of their x, y and z (depth) co-ordinates. As a high-resolution film image may contain many thousands of objects, this process, known as 3D or solid modelling, is extremely time-consuming. One technique is to build up complex objects from 3D "primitives" — polygons such as cubes, spheres, cylinders, pyramids and so on.

To describe a single object such as an aeroplane in this way could mean combining hundreds of different polygons. On flight simulators it typically takes at least a week to

model a new plane.

Creating images of irregular objects with sculptured surfaces is even more difficult. In 2D you can trace an outline of a shape simply enough using a digitising tablet. But there is no equivalent device for entering 3D dimensions as easily.

Recently a computer graphics company wanted to show a perspective image of Rodin's sculpture, the Thinker. To enter it into the computer the programmers had to resort to making a physical model of the sculpture, and slicing it up for measurement.

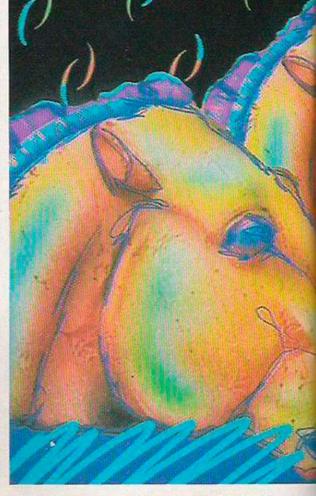
The ideal solution to these problems has already been postulated by computer graphics experts — a sculpting system. Like a 2D painting program it would allow you to create free-form designs but in 3D. With an electronic "chisel" you would be able to chip away at the image of a block of marble or mould a pixel-based lump of clay.

When it comes to modelling natural phenomena such as leaves or mountains rather than describe the objects you may need instead to supply a procedure or algorithm for generating their images.

Fractal features

One such procedure exists for creating irregular and crinkly lines. Known as "fractals" they have been used for some highly realistic displays of mountain displays.

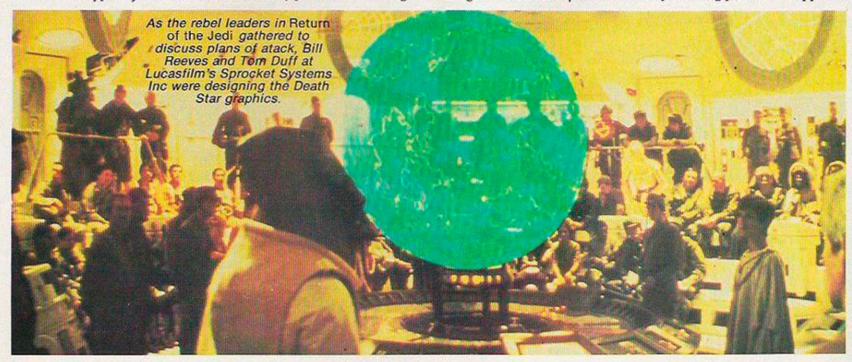
In Return to Fractalus, a computer game designed by Lucasfilm for Atari, fractals are employed to construct a constantly changing landscape. Apart from spaceships and gunposts none of the game's images are stored.

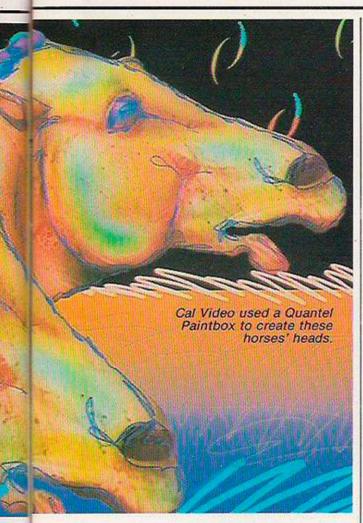


Once you have modelled your 3D objects there are numerous steps yet to be taken before they can be displayed as convincing perspective images. For a start you need to calculate which co-ordinates lie within the limits of the display; those outside need to be removed by a clipping procedure. Since the 3D images are to be displayed on a 2D screen the co-ordinates must then be converted to give a perspective view.

At this stage objects can be shown as wireframe figures. To give the impression of solidity it is now necessary to work out which lines and surfaces will be visible.

Again, this process — hidden line removal — is a lengthy one. In his book Advanced Graphics with the BBC Micro IO Angell suggests that implementing hidden-line removal algorithms is almost beyond the limits of a home micro's processing power. He supplies a





routine written in BBC Basic. It takes 15 minutes to calculate the visible surfaces of a single cube frame figure. By contrast a realistic film display may be broken down into more than a million polygons, all of which must be tested for visibility.

The final stages in computing a 3D image deal with simulating texture, shading and shadows. Providing these effects is an extremely complex business. Among other things it must take into account such features as different light sources, the reflective properties of different surfaces, and the properties of translucent materials like glass.

Smoothing the jaggies

A further problem with forming realistic images is that at all but the highest resolutions raster displays show diagonal lines as jagged — an effect known as "aliasing". One solution is to increase the pixel density. Apple's Macintosh gives an excellent picture by using a density of 80 pixels per inch.

Another solution, which is widely used, is to alter the colour intensities of pixels at the edge of lines. This technique, called antialiasing, smooths out the "jaggies" at the cost of giving lines a slightly blurred look.

The term "raster" refers to pixel-based displays — as found on all home computers — in contrast to vector displays whose images are made up of straight lines. Advanced raster displays use frame buffers to store the colour information for each pixel. In this respect a frame buffer is simply a grander version of the home computer's screen memory.

Naturally generating realistic computer graphics calls for higher pixel resolutions than are found on home or personal computers. If the graphics are to be recorded on video tape then the resolution does not need to be higher than that of a TV display, roughly 600 lines

with 700 pixels across. But for the film the resolution must be mugh higher — sometimes as much as 4096 by 4096.

As the highest resolution currently available on raster monitors is not much more than 1600 by 1200 only a portion of the picture can be viewed at a time. Recording to film involves writing the image directly from the frame buffer to celluloid.

The most advanced raster graphics systems provide for up to 16 million colours at once. This means that each pixel requires 24 bits to hold its colour code. Consequently, storing these images requires enormous amounts of memory, running into megabytes of Ram.

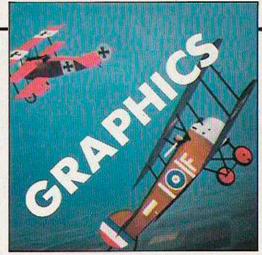
With pixel arrays of this size the number of computations necessary to build up a 3D image is staggeringly large. Many of the frames for the animation in the film *Tron* took over 15 minutes to compute. Even using supercomputers such as the Cray XMP, computer animation companies may take days to produce a minute of film. For complex scenes real-time animation is a long way off.

In the world of computer graphics real-time can mean any speed from 10 frames per second to the rate at which television images are transmitted, 25 fps.

Where less complex scenes are concerned some computers are certainly capable of real-time animation. Flight simulators project semi-realistic scenes of planes, landscapes, runways, and so on, at rates up to 25 fps. To acheive these speeds graphics computers use dedicated hardware to handle such tasks as clipping, anti-aliasing, rotating, and shading.

The Bosch FGS-4000 is one of the more advanced systems, suitable for generating the sort of animation used in advertising and TV title sequences. So long as only a limited number of polygons are involved the FGS can rotate or translate 3D shapes in perspective view, and supply effects like shading and antialiasing — all in real-time. For animation you need only to define two "key" frames at the start and stop positions: the FGS then creates a sequence by a process known as "inbetweening".

Needless to say very few of these effects are possible on home micros. To achieve high quality graphics micros will need more



memory, greater resolution, and more processing power.

Larger memory capacities and greater resolution go hand in hand. Take the memory required to hold a picture with a resolution of 1024 by 1024, giving over million pixels. If you want to have up to 256 colours on screen simultaneously you must allocate one byte for each pixel. Altogether this amounts to 1024K.

Since 8-bit processors can only address a maximum of 64K, high resolution on home micros will thus demand 16 or 32-bit processors. More powerful processors will also be able to handle the amount of number crunching needed for 3D perspective graphics: 8-bit processors are simply too slow.

Spectrum speed limit

To give an example, the Spectrum 3D Rotator program in this issue rotates a cube at a respectable rate of 10 frames a second. Written in machine code it probably represents the limit of the Spectrum's speed. But it only handles a wire frame figure and when two cubes are rotated the routine is considerably slower.

Nonetheless the prospect for graphics on home computers looks promising. Advance graphics chips are being developed for 3D image processing, while the cost of large memory stores is falling. One forecast suggests that in 10 years personal computers will come with 1024 by 1024 resolution and built-in antialiasing. When systems like this appear then the home user might indeed be able to start creating Loren Carpenter's imaginary landscapes.





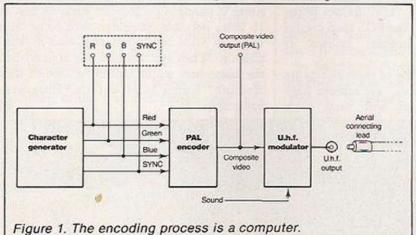
ALL HOME COMPUTERS have a TV output to enable owners to use their TV set as the visual display unit - VDU. As the level of sophistication of both computers and software increases, so does the need to display finer-detail graphics -so-called high-resolution graphics-or more text characters per line as in word processing. A TV set is not designed to cope with such demands.

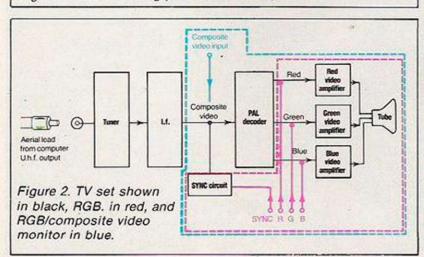
Inside a computer, characters and graphics start life as separate red, green and blue signals, together with a synchronising signal to "lock the display". Most machines have a separate output socket for these signals which is used to drive a monitor. The same signals are combined together inside the computer to produce what is known as a composite video signal which for the U.K. and most of Europe would be colour-encoded according to the PAL system.

Some machines make this signal available instead of the separate red, green, blue - RGB - and sync signals. Examples are the Commodore 64 and Dragon. This is a pity since combining them in the PAL format results in very substantial losses in quality. This is due to a number of factors which relate to the PAL system, but PAL was developed specifically for encoding TV pictures and nothing else.

Incidentally the Acorn BBC computer offers a composite video output, in addition to RGB, but without the colour information, in other words a monochrome composite video signal which has not gone through PAL encoding. This makes it very useful for driving monochrome monitors in applications such as word processing.

Inside the computer, the encoded composite video signal is then passed to a modulator which converts it to a RF signal suitable for feeding into the aerial socket of a TV set. Again a certain degradation occurs. In the TV set, a tuner is used to receive the RF signal, and an IF — intermediate frequency — stage converts





We chose eight of the most popular computers and looked at the commonly available monitors to suit each one. Use this buyers' guide in conjunction with the main article to ensure that you make the best choice. Our guide does not include TV-monitors; monitors which are designed specifically for upmarket computers or monochrome monitors.

We tried to major on products which were reasonably easily available and therefore our list is not necessarily comprehensive. The prices quoted are manufacturers' or distributor prices; with some products it is possible to find them discounted so it's worth shopping around. None of the manufacturers we spoke to had done final testing on MSX products so rather than taking any risks on accuracy we decid-

ed to exclude these machines.

It is very likely that some MSX manufacturers who are also TV manufacturers — e.g., JVC and Toshiba - are likely to introduce TV-monitors suitable for these machines. In any case, the requirement is only for standard resolution and therefore it's back to TVmonitors.

MONITORS

it back to a composite video signal. A colour decoder then converts it back to RGB and this is used to drive the video amplifiers and hence the tube. All this encoding and decoding takes its toll and the resulting RGB signals inside the TV set are a poor cousin to what started out in the character generator of your computer.

The best possible results are obtained if RGB is fed to a RGB monitor. Some improvement is noticeable if a PAL composite video signal is used to drive a composite video monitor.

An increasing number of TV/monitors are becoming available which combine all three, i.e., TV set, composite video monitor and RGB monitor. These are currently confined to the low end of the resolution ladder.

If you take a look at figure 2, it will become obvious that a RGB monitor is really a TV set but with the tuner, IF and colour decoder sections missing. So why are they more expensive than a TV set?

First, on purely commercial grounds, they are produced in smaller quantities than TV sets so monitor manufacturers do not enjoy the economies of scale as TV manufacturers. Secondly, the design of a monitor is different. Monitor tubes cost a lot more than TV grade tubes — standard resolution monitors use TV tubes — and more attention is paid to the geometry, setting up, picture size stability, bandwidth and many more parameters, all of which makes them more expensive to produce.

The colour tube, as found in both TV sets and monitors, has three electron guns which, when activated, each send a beam of electrons which hit a particular type of phosphor and emit visible light whose colour is dependent on the type of phosphor. The three phosphors used — one for each gun — produce red, green and blue light. The control circuitry switches each gun on.

In the case of logic — on/off — signals, the control circuitry for each gun — the video amplifier — can switch that particular gun on and off. Depending on the control commands from your computer all three guns can be on or off or of course any one or two guns can be on at any one time — in all eight permutations. Table 1 shows the control for an eight-colour computer with 0=off and 1=on.

Some computers offer 16 or even more colours. There are several ways this can be achieved. For example, each output can have three states: off, half-on and fully on. On a TTL 5 volt system the off state is 0V, the half-intensity is 2.5V and the full intensity is 5V. Another variation is to have an extra control bit called intensity and this method — used on the IBM PC — retains the TTL on-off signals.

An even more sophisticated approach is similar to the first example but the outputs can be level-defined under software control from 0V to 5V in several steps. The greater the number of steps, the larger the permutation of colours. A total of 64 colours is considered to be the limit, since the difference between light brown and medium brown may not be too apparent on the screen.

For the home computer owner there are two types of monitor: RGB and composite video. The latter usually has RGB input capability as well as composite video, has a built-in audio amplifier and speaker and is therefore more (continued on next page)



A monitor is often high on many computer owners' shopping list. In this feature we examine the different types available and explain how to choose one that best suits your purposes; plus a buyers' guide to the most common models.

able 1.			
Red Gun	Green Gun	Blue Gun	Screen
0	0	0	Black
1	0	0	Red
0	1	0	Green
0	0	1	Blue
1	1	0	Yellow
1	0	1	Magenta
0	1	1	Cyan
1	1	1	White

LIST 1. ACORN BBC OR ELECTRON. ORIC. RESEARCH MACHINES RM480Z.

Key: L = Includes leads

G = antl-glare screen

T = green-only button

S = selective transmission glass

		Price	Resolu		Tube		outs		Plastic	Metal	Case	Country	
Manufacturer	Model	inc.VAT	Standard	Medium High	size	RGB	Composite video + RGB	Sound	case	case	colour	of origin	Comments
Microvitec	1431/MS	2299			14"						brown/beige	UK	L .
Microvitec	1451/DS	£299		•	14"				0		brown/beige	UK .	E war on
Microvitec	1441/MS	£506			14"	0				0	brown/belge	UK	La mayor to
Microvitec	1441/DS	2506		•	14"				0		brown/beige	UK	L Marie
Compuser	2000	£325			14"						cream/black	UK	L,G,S
Compuser	2000R	2325		•	14"				0		red/black	UK	L.G.S
Novex	1414	£215	0	and the second	14"						cream/black	Talwan	L,S,T
Novex	1416	£368		0 10 10	14"						cream/black	Talwan	L,S,T
Novex	1418	€431.25			14"	•					cream/black	Taiwan	L,S,T
Kaga	Taxan Vision II	£327.75		•	12"				0		cream	Japan	
Kaga	Taxan Vision III	2458.85		e =	12"				•		cream	Japan	

LIST 2. SINCLAIR SPECTRUM.

Manufacturer	Model	Price Inc.VAT	Resolu Standard	tion Medium High	Tube size	RGB	uts Composite video + RGB	Sound	Plastic case	Metal case	Case colour	Country of origin Comm	ents
Microvitec	1431/MZ3	£259	•		14"	CONTRACTOR OF THE PARTY OF THE	cial inter-				Black	DK L	
Compuser	2000S	£370		• 1000	14"		face)	•	•		Black	OK L	

(continued from previous page)

expensive. Incidentally, a composite video monitor can be used to advantage with a modern VCR which has video and audio outputs — most have. The choice depends on which computer you own.

The next variable is resolution. First, let's define resolution: it is the ability of a monitor to display clearly or resolve a given number of pixels or picture elements. Your computer sees the monitor as a sheet of graph paper and controls each "square" individually. The degree of required resolution is dependent on both the computer's capability and the software. There are three common grades of monitor: standard, medium and high.

Standard types use TV grade tubes which have a "pitch" of around 0.6mm. The pitch is the distance between adjacent groups of phosphors on the face of the tube. This is by far the most important parameter which determines a monitor's resolving ability. The closer the distance between the phosphors, the greater the number of phosphor groups — a group contains three phosphors — one red, one blue and one green — that can be squeezed in over the face of the tube and therefore the more pixels it can resolve.

Gives excellent results

Going back to standard resolution monitors, a 14 inch 0.6mm pitch tube will resolve around 450 pixels per horizontal line. This gives excellent results for text which has 40 characters per line. A 20 inch equivalent using a 0.8mm pitch tube is capable of around 500 pixels. Notice that the degradation of pitch — from 0.6 to 0.8mm — is more than made up for by the increased screen size which simply allows more phosphor groups to be laid down.

Standard resolution monitors are available in both RGB and RGB/composite video versions. We do not, however, recommend them since they represent very poor value for money compared to a TV-monitor like the new Ferguson MC-01. As far as performance is

concerned there is nothing to choose between any standard resolution monitor and a TVmonitor so, unless there is a special reason such as a requirement for a metal-cased unit, we suggest you look around and compare deals on TV-monitors.

The next step is medium resolution. For a 14inch tube with a nominal pitch of 0.43mm, the resolution is about 580 pixels. Again these are available in either RGB only or RGB/composite video with sound. For most applications and for most computers, this is the resolution we would recommend. Prices have come down recently and they now represent good value for money.

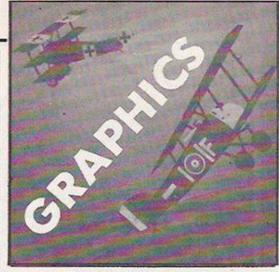
A medium resolution 14inch monitor will resolve 80 characters per line — just! If you use your computer in this mode for most of your work, it isn't quite good enough but it is a substantial improvement overall as compared to standard resolution.

If you do make extensive use of 80-character text — word processing for example — then we would strongly recommend that you buy a monochrome monitor for around £80. These give a better display than any colour monitor at a fraction of the price but they are no good for games or any program which has colour

Table 2.	Games or general use	Text or business use	Combined
TV-monito		0	1
Standard- res. Medium-	0	0	0
res.	2	1 2	2
High res. Mono-			
	0 ot recomm III do	ended	0

Bear in mind that these ratings take many different aspects into account, including price, and they are therefore subjective.

2: Good



graphics. The only other alternative is a high resolution colour monitor. Staying with our example of a 14inch unit, these have a pitch of 0.31mm and a resolution of about 800 pixels.

They are perfectly suitable for 80-character use but they are very expensive — over £400. This tends to put them beyond the reach of most home computer users unless you are using your computer as a business tool or have a lot of money. Table 2 is a quick reference.

Bandwidth figures meaningless

Video bandwidth figures are very often quoted but are really quite meaningless and you should not use them as a measure of the overall display quality. Video bandwidth is the ability of the video amplifiers in a monitor to reproduce high frequency — i.e., fast switching — signals without degradation. It is quoted in MHz or megahertz and is usually the frequency at which the output of the amplifiers drops by 3dB as compared to lower frequencies.

It is the monitor designer's job to ensure that there is more than adequate bandwidth for the type of tube used. As a guide, a standard resolution TV-type tube requires 6MHz, a medium resolution tube around 10MHz and a high resolution tube about 12MHz. No advantage will be gained if you drive a standard resolution tube with 20MHz amplifiers.

LIST 3. DRAGON	COMMOI ATARI.												
		Price	Resolu	rtion	Tube	Inpu	ıts		Plastic	Metal	Case	Country	
Manufacturer	Model	Inc.VAT	Standard	Medium High	size		Composite video + RGB	Sound	case	case	colour	of origin	Comments
Microvitec	1431AP/MS	£259	•		14"		•	•		•	brown/beige	UK	L
Microvitec	1431AP/DS	£259	•		14"		•				20.72.24.44.44.44.15.7.2.50.	UK	L
Microvitec	1451AP/MS	£375		•	14"		•	•			brown/beige	Marie Control of the	L
Microvitec	1451AP/DS	£375		•	14"			•	•		brown/beige	UK	L
Microvitec	2030/CS5	£443	•		20"		•				brown/beige	UK	L
Microvitec	2040/CS5	2788		•	20"		•			•	brown/belge	UK	L
Compuser	2000C	£370		•	14"		•	•	•		cream/black	UK	L,G,S
Compuser	2000K	£370		•	14"		•	•	•		grey/grey	UK	L.G.S
Novex	1414	£215	•		14"		•	•		•	cream/black	Taiwan	L,S,T
Kaga	Taxan Vision												
	Ex	£247.25	•		12"		•	•	•		cream	Japan	
LIST 4. SI	NCLAIR QI												
		Price	Resolu	tion	Tube	Inpu	its		Plastic	Metal	Case	Country	
Manufacturer	Model	inc.VAT	Standard	Medium High	size	RGB	Composite video + RGB	Sound	case	case	colour		Comments
Microvitec	1451/DQ3	2275		•	14"	•			•		Black	UK	L
Microvitec	1451/MQ3	£275		•	14"	•				•	Black	UK	L
Compuser Kaga	2000Q Sinclair Vision	£325		•	14"	•			•		Black	UK	L,G,S
	QL	£299		•	12"	Dading.					Black	Japan	

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Mike Gaines flies a reconnaissance mission for Your Computer. SINULATORS

Most Boys from 8 to 80, dream sometimes of becoming a fighter pilot — whether the First or Second World War variety with silk scarf and leather helmet — or the modern Darth Vader lookalike. Few get the chance to try their hand in an aeroplane, even fewer make it on a fighter squadron. And then there are those who fancy a career driving airliners full of sunburnt tourists clutching stuffed donkeys back to Gatwick or Luton.

I'm luckier than most, I get to pick and choose what I fly in, when I fly, and what sort of flying. So I am fairly au fait with most types of lufting. But the great thing about flying a simulation program is that you don't get hurt by your mistakes and that experimentation is possible. Can you barrel roll at F-15 at 200ft and get away with it? The computer says yes, although I wouldn't recommend attempting it in the real thing.

Fighter Pilot puts you in the cockpit of a McDonnell Douglas F-15 Eagle. The program is well written, within the bounds of what has been published on the F-15 — remember its the latest US Air Force fighter.

The aircraft handling is realistic and aerobatics are possible in all planes. The view from the cockpit is daytime, with green land and blue sky. Five modes are available; landing, flying training, blind landing, air combat training, and combat. In the latter you are on ground alert at base with responsibility to defend it, plus three other airfields.

The instrumentation is good with clear easy-to-read digital read-outs of height, speed, and rate of climb/descent. The attitude indicators consist of a small articifial horizon type aeroplane for roll, with a two-colour pitch ladder — nose up/down — which is particularly useful as the outside visual shows only unrelieved green or blue.

A multi-role indicator gives enemy aircraft — bogey — height or distance in latitude and longitude. A "radar" shows the bogey's position from you in azimuth — or your position from a beacon, if selected — his range/bearing and your heading. A strip read-out gives thrust, turning red when afterburner is selected — watch your fuel level drop accordingly. Other indicators show flap/gear positions and cannon rounds remaining.

The basic idea is to take-off — hold it on the brakes till full afterburner is engaged, then whip the gear up quick, pull to 90 degrees pitch and zap up to 30,000 ft, cancel the burners and pull inverted, roll out, and select map; a quick glance at where the bogey is heading then set course for intercept. Switch on the gunsight and the flight computer for a

read-out of the enemy aircraft's height. When you've got the bogey dope, work out your tactics. The program will only let you see the other guy at ranges of less than a mile and within 5,000ft height difference. This makes a head-on pass — you only have guns, no missiles — practically impossible but you can get in below him and as the range comes down to a mile, pull hard and roll out in his six o'clock position.

Overall, Fighter Pilot would be hard to improve besides the addition of radar and heatseeking missiles and some ground detail. Terrific fun and realism — will the programmer, D.K. Marshall, now write a similar groundattack game based on, say, the Harrier?

A different game altogether is Nightflite II, again played on the ZX Spectrum. This puts you in the seat of a light aircraft. The visuals depict a runway flarepath at night with a few random lights dotted around. This is purely an airmanship trainer. I found it both excellent and fascinating. The best mode is the one that dumps you in the middle of nowhere and you have to navigate back using VOR and ADF plus a DME, to intercept the ILS to land. The only hazards are mountains to the north and west of the field.

After trying Fighter Pilot, my first reaction to Nightflite was to find it boring. But it really is a more exacting and realistic test of your flying skill than blasting about kidding yourself that you can fly because you can loop at 30,000ft. An interesting light aircraft variation could combine the best of both worlds, with a day visual and performance based on that of the Pitts S-2 Special.

Protek's Airliner I found quite frankly, awful. The graphics consist of a very crude representation of an aircraft cockpit. If the Ancient Egyptians had launched papyrus and bamboo aircraft from the Pyramids then this is the type of instrumentation they probably

	Game . Airliner	Company Protek	Price £5.95
	Fighter Pilot	Digital Integra- tion	£7.95
1	Flight		
1	Simulator II	SubLogic	240.00
1	Nightfilte II	Hewson Con-	
1		sultants	£7.95
I	Solo Flight	MicroProse	
1	THE MALL	Software	£14.95
1	Spitefire Ace	MicroProse	
1		Software	29,95
-	Sub Hunter	Micro Mart	
ı		Software	£6,95
1	Wing Com-		
1	mander	Creative	
1		Sparks	£7.95

would have developed for night/blind flying. The blurb says that the program represents a BAC1-11 airliner and indeed, this aircraft's silhouette is shown on a pink (!) artificial horizon. There is no view of the outside world, just a bunch of crude dials and the pink airliner.

You type in the call-signs of various navigation aids in the Edinburgh area — watch the read-outs and dials churn over and set up for a blind landing or, by changing modes, obtain a view of the airport on the "head-down-display" — neé artificial horizon and map — it's rather like piloting a letter box. This is a shame really, the basic program is pretty good but ruined by non-realistic presentation. After all, if you don't get the "feel" however slight that you are actually airborne then there is not much point is there? In its present format it's like watching a bunch of clocks, truly boring.

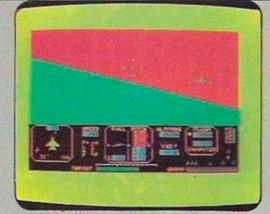
A completely different kettle of fish is J Dyer's Sub-Hunter., This excellent program simulates the RAF's Nimrod, a large four-jet designed specifically to hunt and kill submarines.

An extremely complex program, as evidenced by the time taken to load into the Spectrum Plus, Sub-Hunter reflects the sophistication of the real aircraft — Nimrod is the most advanced aircraft of its type in the world. Sub-Hunter itself is probably more complex than the real anti-submarine aircraft of only 20 years ago — still in service with some nations.

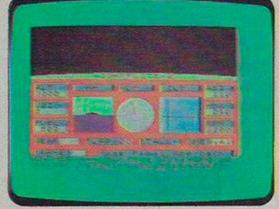
In this game, a submarine is submerged somewhere within a 24n.m² area of ocean. All you have to do is detect it, locate it and kill it. To aid you the aircraft has three main sensors — four counting the radar which, on game start, tells you very roughly where to start searching. The Magnetic Anomoly Detector — MAD — picks up variations in the Earth's magnetosphere caused by large metal objects such as a submarine. Switch this on and get low, it only works at low level.

Other sensors are passive and active sonobuoys. These are dropped into the water and transmit data back to the aircraft. Passive buoys only listen for the sub and can only detect noise sources within two miles. The active buoys transmit a "ping" and can detect a sub out to three miles. But the submarine can hear an active buoy and take evasive action accordingly. Both buoys have a life of 15 minutes so don't drop the lot at once.

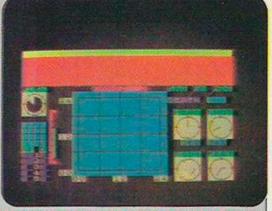
This game is quite complex and realistic and can be played by two or three people; one flies the aircraft, one looks after buoy and weapon dropping while another acts as captain, directing the other two — great fun.



Above Fighter Pilot from Digital Integration.



Above: Nightflite II from Hewson Consultants:



Above: Sub Hunter from Micro Mart Software.

Another realistic game is Wing Commander which is played on a Commodore 64. Once again this is a fighter game. The basic mission is to defend an island which, probably coincidently, looks a bit like East Falkland. On the island are two airfields, two naval bases, an industrial complex and a couple of cities, with a ship anchored offshore. These are targets, you are on the end of the runway in an F-15-similar fighter armed with cannon and four Sidewinder heat-seeking missiles.

The visuals are quite good, although the aircraft handling is not as crisp as that of Fighter Pilot. One annoying point is that the speed is shown in rather unusual feet per second or somesuch, instead of knots.

However, this program has what Fighter Pilot lacks, the ability to perform head-on missile attacks.

Another refinement of Wing Commander is the ability to refuel in the air. The height, speed, and heading parameters to achieve this are quite strict but this is realistic enough.

Spitfire Ace, from Microprose for the Atari and Commodore Micros, is not really a flight simulator, more of a joystick-operated aircombat game. You do get a view out of the cockpit window, with a gunsight, and you get to chase and shoot down enemy planes.

However, the control panel is rudimentary, the scenery primitive, and the simulation is wholly unrealistic. Everything happens at arcade game speed, and there seems to be no relation between what you can do with the Spitfire you are supposed to be flying and the real thing.

The game appears to offer 14 different scenarios such as France, Blitz, D-Day and so on, but they all look about the same — except the ones that take place at night. The ground is detailess green, which makes landing or ditching tricky.

Neither as a combat game nor as a simulation is Spitfire Ace as good as Star Raiders. However, in dog fights it does get you leaning from side to side in your chair, so it must have some species of merit.

Solo Flight, also from Microprose for the 48K Atari and Commodore micros, is reasonably complex. It offers a good control panel at the bottom of the screen, and a three-dimensional view of the landscape at the top. This has a few mountains on the horizon, and some sketchy airfields on the ground. The Atari version adds shading through the use of display-list interrupts which, of course, the Commodore 64 can't do.

The odd thing about the graphics is that you can see your own little plane through the cockpit window. The resulting loss of realism makes it more like flying a toy plane.

Like Spitfire Ace, Solo Flight is a joystickoperated game.

Below: Flight Simulator II from SubLogic.

If you get tired of flying you can play a mail game — you have to deliver bags of mail to five different airports in the shortest possible time.

Solo Flight offers three different areas to fly in — Kansas, Washington/Oregon and Colorado. You can also fly by instruments, if you can work out what's going on. Amazingly enough, there isn't a cockpit diagram in the 16-page handbook supplied.

Apart from that, Solo Flight is a pretty good simulator. Unfortunately it pales into insignificance against Flight Simulator II.

Bruce Artwick's Flight Simulator II is now the unchallenged leader among flight simulation programs for micros. It's available from SubLogic for everyone with an Apple, Atari or Commodore 64 with a disc drive and around £40 to spend.

The program is an accurate simulation of flight in a Piper 181 Cherokee Archer. Over 40 controls and indicators are shown on screen, along with a colourful three-dimensional view out of the cockpit in the direction of your choice — front, back, either side and down.

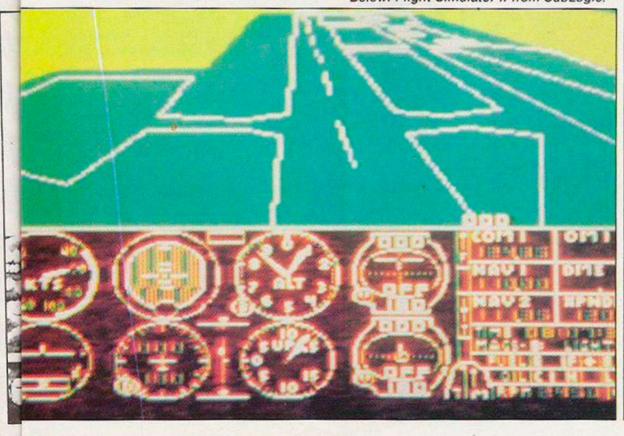
The instrument panel includes all the usual stuff plus two navigation radios, clock, magneto switch position indicator, gauges for the right and left fuel tanks, mixture and throttle control indicators, and aileron, elevator and rudder control indicators and lots more. These help you to fly day or night, and in this simulation, one does change logically into the other.

The flying area covers all of North America, which is mostly blank, with detailed land-scapes on a separate disc for four separate areas: Chicago, New York, Seattle and Los Angeles. Other areas are now being coded using maps, charts and aerial photographs.

The simulation also provides a choice of four seasons, cloud layers, surface wind and wind at three levels — with turbulence factor — as much nasty weather as you could want, and more.

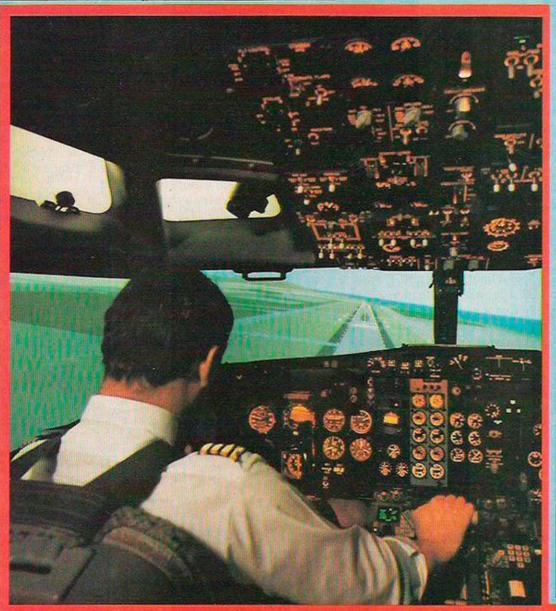
All of this is explained in great detail in a 90-page manual. There is a second 92-page manual of Flight Physics and Aircraft Control, with an introduction to aerobatics. This ends with the warning "Please do not attempt these maneouvres in actual flight with a real airplane unless accompanied by a qualified flight instructor experienced in aerobatics" — meant to be taken seriously. You really start to think that if you can fly this simulator you can fly anything!

If you get tired of aerobatics there's also a "World War 1 fighter ace" mode.



REACHINGFOR Simon Beesley looks behind THESKY the simulated scenes at Rediffusion's "flying"

machines and discovers an amazingly believable display.



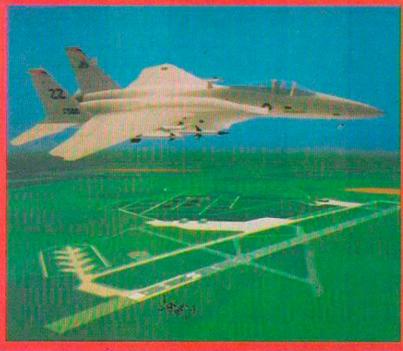
IN THE FIELD OF computer graphics Britain has lagged behind. The most interesting work, such as ray tracing or feature film animation, is being done in America and Japan. The one exception here is in the graphics used on flight simulators.

Rediffusion Simulation is one of the top three companies in the world manufacturing flight simulators. At the company's factory in Crawley, Sussex a number of simulators are lined up in two rows. With their flight cabins perched 25ft. up on six hydraulic jacks, they look like forerunners of George Lucas' At-At Walkers from Star Wars. One of them is in operation but the only sign of it is that the jacks have extended a further 5ft. The pilot is probably cruising smoothly at 30,000ft.

To enter the cabin you mount a ladder. Inside there is a perfect reproduction of the interior of an aeroplane cockpit - from the instrument panel right down to the seat covers. But most startling is the view out of the window.

For those who want a technical description, it gives a field-of-view which extends 200° horizontally by 40° vertically. Five calligraphic projectors throw the image on to a back-projection screen. It is then reflected into the flight deck by a large diameter collimating mirror. This system, named the Wide II display, is unique to Rediffusion's simulators. Less advanced models use monitors clamped to each window.

What the mirror shows is an amazingly believable computer generated display with real-time animation. From the air, at least, features like fields, mountains, and airport buildings look remarkably realistic. Other





planes, in particular, are shown in fine detail complete with markings and transparent canopies.

Along with these, the display can reproduce a variety of atmospheric effects: clouds, fog, horizon glow, and at night or dusk a twinkling constellation of city lights.

Perhaps the most impressive scenes are produced on the units which simulate fighter planes. On these you can practise formation flying, refuelling in mid-air, or bomb a variety of moving and stationary targets such as bridges, factories, trains and patrol boats.

If you plump for air to air combat you can do battle with another pilot or take on the computer. The average arcade fan would feel instantly at home here. The difference is that the visual effects, which include anti-aircraft flak, explosions and heat seeking missiles, are a hundred times more convincing.

On top of this the flight cabin threatens, at times, to tip you out of your seat. At take off the cab tilts up and from then on the motion control system supplies the sensations you would experience in an actual flight - smooth low-velocity movement, rapid acceleration, Gforces, banking from left to right, the lot.

All this is delivered by six hydraulic jacks which are both extremely powerful and highly responsive. They can rotate the cab in six axes as well as move up and down, forwards and backwards. Helicopter simulators also include vibration platforms.

Pre-recorded sounds extend the illusion with engine noises and the whistle of the air-flow, or, on helicopter simulators, the sound of rotors and gear changes.

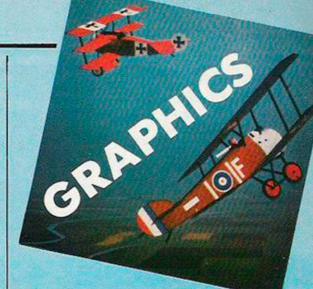
Flight simulators, in fact, reproduce all the sensations of a real flight, short of smell. They have to, in order to satisfy airline authorities' training regulations. Pilots now receive a large part of their training on simulators. And Britain's Civil Aviation Authority even tests simulators for air-worthiness, as it would a real aircraft.

The costs of training on real aircraft are enormous. A Jumbo, for example, consumes 21/2 tons of fuel in take-off alone. So learning to fly on a simulator is a lot cheaper.

It is also, of course, safer. You can practise coping with an engine failure, or landing on an icy runway - without leaving the ground.

Another advantage is that simulators are delivered with visual databases which match the features of particular airports. Pilots can familiarise themselves with the layout of runways and buildings at Heathrow, Washington, Hong Kong, or any major airport.

For a radius of up to 15 miles around the airports the databases hold the features of "realworld" terrain. Real-world means that the terrain corresponds to navigation maps. In other words, you will find a river where you expect it to be. The objects on the ground are not shown in the same fine detail as the planes themselves. While objects like trees or build-



ings appear solid and shaded, they tend to have a rather Toytown look about them.

But flight simulator companies are constantly improving the quality of their displays. As John Bastow, Visual Sales Manager for Rediffusion, put it, their customers are shrieking for more realism: "They want to see leaves on the trees, or the wind rippling a cornfield". The latest systems map texture patterns on to horizontal surfaces to simulate waves or grass. Effects like these are not just cosmetic: close to the ground they give the pilot valuable height and speed cues.

As it is, flight simulator graphics are the most advanced examples of computer animation to be found. A typical image might be built up from over 1,000 polygons, shown in perspective view, and smoothly shaded. The pixel resolution is around 600 by 700.

To generate images of this complexity at a rate of 25 frames per second calls for very specialised hardware. The task has to be distributed to a number of processors which work simultaneously on different parts of the problem - clipping, anti-aliasing, computing 3D transformations, and so on. Rediffusion's simulators use image-generating processors made by Evans and Sutherland, coupled to a fast 32-bit Gould computer.

Not surprisingly none of this equipment comes cheap. The image generators cost more than \$1 million while a complete flight simulator carries a price tag of at least \$5 million. Rediffusion only sell 10 of them a year and each takes 18 months to build.

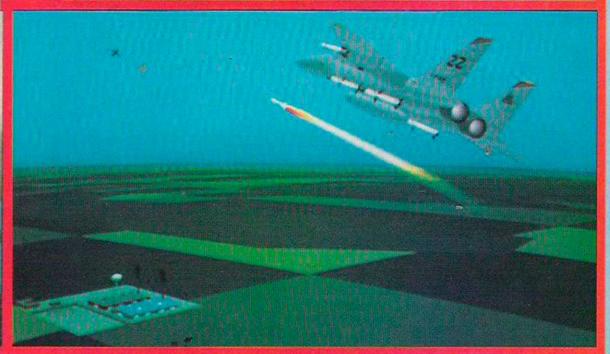
All of which rules out the possibility that first occurs to most home computer owners - that a flight simulator would make the ultimate video game.

For the moment we will have to be content with Rediffusion's first leisure application, a space ship simulator. This uses the motion control system without the computer graphics. Instead the cab's movement will be synchronised with film sequences.

When it opens next year in Toronto, this venture will take visitors on a simulated tour of the universe. Rigged out as a space capsule, the interior of the cab will house a 40-seat cinema.

The system could also be adapted to simulate a ride down the Cresta Run or a dog-fight. Of course it is still a poor substitute for a ride in a proper flight simulator. It lacks the allimportant feature which computer graphics supply: the ability to control the scene yourself. But it may be some consolation to know that you can use a simple joystick to resynchronise the leisure capsule. Apparently you could even run the necessary software on a BBC Micro.





Merion Jones looks at games machines which use laser discs for more realistic action.

BORED WITH WORK you sit down in a special | chair and as the lights fade one wall of the room dissolves to reveal deep space rushing past filled with images of hostile spacecraft plunging towards you. As you fire the lasers the whole chair seems to shake with the shock.

Science fiction - not quite. Next spring Pioneer intends to start selling its PX-7 MSX computer in Britain together with the new LD-700 laser disc player. These are designed to interface together so you can play the Dragon's Lair and Astron Belt style arcade games which combine sequences of real film or animation and computer graphics on screen to produce the most realistic video games yet.

Instead of waiting for the slow progress in colours and resolution to drag computer games out of the stone age as far as graphics is

concerned we can jump straight to the sharp focussed images of film and television. In America RDI Video Systems, the company which developed the

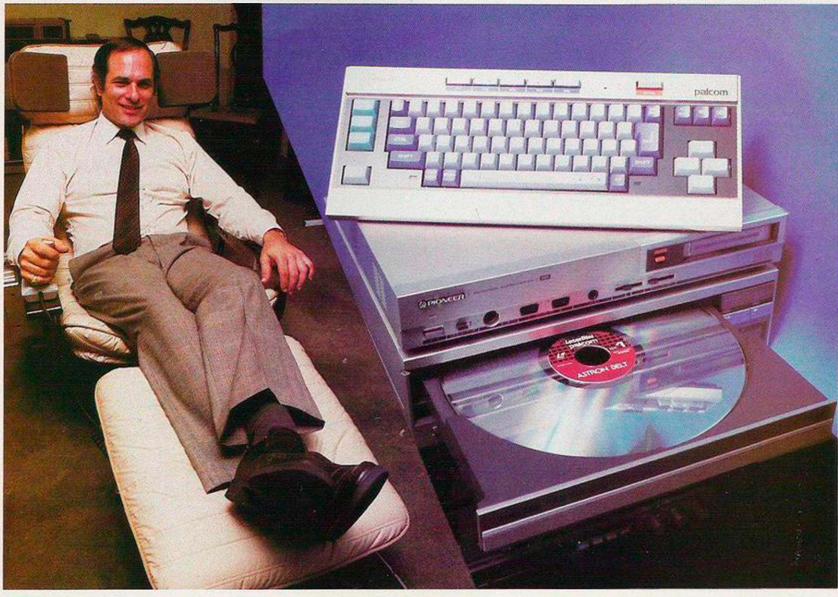
technology to bring Dragon's Lair to the arcades, has already launched a similar videodisc based games machine for the home called Halcyon. Halcyon has the additional gimmick of voice synthesis and recognition so you can shout your instructions to it as you play games like The Spirit of Whittier Mansion - a horror film which stars you.

In Europe Philips, the company which first developed laser discs, has launched its first MSX computer and is now working on inter-

ONEER facing that to its Laservision units to produce

the same effect. Back in Japan one of Pioneer's rivals, JVC, has just released its third MSX computer which interfaces to its VHD video disc, again to combine film and graphics on screen. One of the games for the JVC is a version of Pole Position using film of a real race track. In Britain Acorn has been using Pioneer's laser disc linked to a BBC Micro as the basis for its interactive video project.

Meanwhile somewhere in North West







London in a heavily curtained room Pioneer has been demonstrating its system with the added sophistication of the Bodysonic chair. You slide the shimmering Astro Belt laser disc into the front loading LD-700 video player and then sink into the Bodysonic while the LD-700 downloads the control program into the PX-7 which is a standard MSX computer apart from its video interface capability.

Both the PX-7 and LD-700 are designed to fit into a standard Pioneer Hi-Fi rack — 19 inches wide, a couple of inches high with all the controls on the front — in the PX-7's case including slider volume controls. The keyboard is a separate IBM PC style detachable. The Japanese NTSC models use a silver and lilac colour scheme but the British models will be the traditional high-tech funereal black.

When you're seated comfortably and the program is loaded your encounter with the Astro Belt begins. On to a background of Star Wars style film clips generated from the disc the computer throws a crude outline of what is supposed to be your ship up on screen. The control program already loaded synchronises the locations that you fire at with the position of the filmed attackers on screen and if you hit them a rough and ready computer generated explosion marks the spot.

As you sit in the Bodysonic chair all the sound is fed to you through speaker wings on either side of your head. Meanwhile three subsonic transducers, one in the footrest and two in the chair, shake your whole body every time your ship is hit — using the same Surroundsound system specially equipped cinemas used when showing earthquake or volcano movies.

Geoff Pflaumer, who is in charge of marketing the video system for Pioneer, explains how the game becomes more challenging at higher levels: "They tend not to shoot back so much on level one — but on level five if they shoot you actually die — 25,000 volts are fed through to the chair". For a second you wonder, and perhaps take a little more care in picking off the aliens before remembering that Pioneer has abandoned its old slogan "Everything you hear is true", and traded it in for "The future of sound and vision".

Using laser discs should mean more than just better computer games — it should also help to unleash the educational potential of micros. Because laser discs use millions of reflective pits scanned by laser they can hold tremendous quantities of information — 36 minutes of film on one side of a disc or 108,000 still pictures. As Geoff Pflaumer puts it, "You could contain the Encyclopaedia Americana, Brittanica plus any other encyclopaedia of your choice on one disc".

On the next disc in your collection you could have "every picture in every museum in the western world". The other advantage is that because the surface of the disc is sealed in a transparent layer and the playing mechanism does not touch the surface of the record they should survive almost indefinitely.

They are certainly tough — Geoff Pflaumer insisted on demonstrating this by dancing up and down on one. The alternative to laser discs is JVC's VHD — very high density — discs.

But none of these systems can conveniently be used to record information so they could never take over from floppy discs or cassettes as the main computer storage media. They have also sold in very small numbers compared to video cassette recorders — there are six million VCRs in Britain now — and VCRs have the added advantage that you can record, so what is the computer industry doing to make use of this resource?

The problem with video cassette recorders is access times and lack of random access. Six seconds is the maximum search time for any of 54,000 still pictures on a laser disc even on a domestic unit. You could not implement high-speed race track or space combat sequences easily on a VCR based computer system but you could use it for adventures and education.

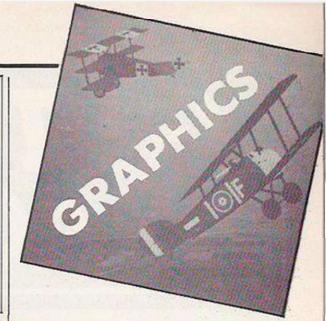
Ivan Berg is one of the software houses working on video-based programs. The Pioneer PX-7 will work equally well superimposing text or graphics on VCR-generated pictures. Also next spring JVC will launch their second MSX machine here which will be designed to work with VCRs.







Table 1.				
Offset	No of Bytes	Parameter	Description	Range
0	1	NUMB	Number of sets of data.	1-255
1	2	ADDR	Start address of data.	
3	2	PX	X co-ord (+ VE LEFT)	
5	2	PY	Y co-ord (+ VE UP)	
7	2	PZ	Z co-ord (+ VE FORWARD)	
9	2	PHI	Angle about X axis	0-359°
11	2	THETA	Angle about Y axis	0-359°
13	2	PSI	Angle about Z axis	0-359°
15	2	DRAWS	Address of free memory after	
4.7		DDAIND	3D data	
17	2	DRAWP	6*NUMB + DRAWS	
19	1	STFLG	Poke this with 0 the first time you use the 3D image.	0 or 25



3D ROTATOR

IN JULY OF LAST YEAR, I wrote a program for Your Computer called 3D Rotator. This program allowed the Basic programmer to manipulate simply defined 3D figures at machine-code speeds. A typical time was 0.5 seconds for a cube. Though this was extremely fast relative to Basic it was not fast enough for practical dynamic games. With this in mind I have speeded up the 3D routine by as much as eight times and made it more versatile. The speeds achieved now are as fast as those seen in commercial games such as 3D Tank Duel, with the advantage that they can be called from Basic.

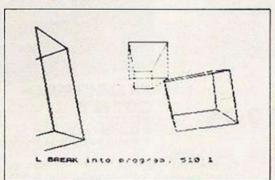
Data is stored as blocks of code at any memory location that you specify. The data should be followed by a blank area which = 12 * (number of sets of data). Therefore the total memory required for any one image = 19 * (number of sets of data). The data itself is made up of three 2's complement numbers and one 1 byte number. A 2's complement number is a 2 byte number where the negative form is 65536-number, e.g., -5 =65536-5 and +5=5: A 2 byte number is Poked into memory as described on page 173 of the Spectrum manual.

The numbers stored are as follows: x coordinate, y co-ordinate, z co-ordinate and the 1
byte number 0 to indicate a plot at x, y, z or 1
to draw a line from the last point plotted to
x, y, z. I include a Basic program — program A
— which will handle conversion of data into a
suitable form for the machine-code program.
The Basic program will also store the essential
parameters such as the pointer to the data,
number of sets of data etc., for that figure.

Producing the data for a simple 3D figure is relatively easy. I refer you for further information to my article 3D Rotator of July 1983 and Ian Angell's article BBC 3D Graphics in the February 1984 edition of Your Computer.

The 3D program allows the parameters for up to 16 3D images. These parameters are stored in fixed areas from 65032 onwards and in blocks of 20 bytes. Thus the start of the parameter area for figure 4 = 4*20 + 65032 - see table 1.

Each 3D image stored in memory should have a separate set of parameters though they Mark Jones with a program which makes his 3D rotator published in the July 1983 issue up to eight times faster.



might share a common set of data. Draws need not point to a memory area after your 3D data but I find I keep track of my memory state better by doing so. For example, fig.0 and fig.1 might both be pyramids and so use the same data. Draws for fig.0 is as normal, after the data, but draws for fig.1 points at another section of free memory and its ADDR points to the fig.0 data.

If it has all seemed rather complicated so far, do not worry — it is really quite easy to use these 3D routines. Here is an example:

To set up fig.0 as a cube first of all work out your data and then store it in data statements in Basic program A. For a cube there are 16 sets of data so adjust line 15 accordingly. The data is going to be stored at 40000 onwards so first of all ensure this area is free from the Basic system with a

CLEAR 39999

and then adjust line 10 accordingly. Finally, this is going to be figure 0 so adjust line 5. Now run program A.

Once the program is complete it will give you a print-out of the next free memory available for data, 40316, and also the position of the parameters area, 65032. If you now wished to have another cube that could move independently of fig.0 then simply make line 10 read LET ADDR = 40316

Line 5 should read

LET FIG = 1

and run the program again.

This is, of course, an example and actual addresses will depend on the number of sets of data you use. Program A as printed will set up fig.0 as a cube as in the above example.

Now to actually produce a 3D image on the screen there are a number of steps:

- Select the current figure by Poking 64976 with the required figure number 0-15.
- RAND USR 64234 actually converts your data to a list of plots and draws stored in the figure's associated free area of memory, pointed to by Draws.
- RAND USR 64692 produces the 3D image on the screen from the list of plots and draws.
- RAND USR 64679 deletes the last image drawn by the above routine.

Therefore using various sequences of these routines you can produce 3D images from within your Basic programs. As an added feature I have included a machine-code demonstration program which will put the current figure indicated by

PEEK 64976

through its paces. The number of steps, and so speed of this demonstration, can be altered by Poking 63501 with a number between 1 and 150.

The routine is called with RAND USR 63500

Finally, to alter a given figures position on the screen, distance from you or angle simple alter the 2's complement numbers PX, PY, PZ, Phi, Theta and Psi in the parameters for that figure.

To run a demonstration of the routines from Basic load with program A and then Goto 5000. This sets up three cubes, shows off the machine-code demonstration and then leaves the three cubes to float around in space spinning.

If you remember the 3D Rotator routine in my last article you may be interested to compare it with these new routines. The routine to handle the 3D conversions is written more efficiently, uses 2 byte x, y,z co-ordinates and does not draw the figure straight away. This allows a number of figures to be produced

(continued on page 97)

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Protek Computing Ltd, 1A Young Square, Brucefield Industrial Park, Livingston, West Lothian. 0506 415353. Telex No. 727559 (continued from page 95)

in memory but not drawn until needed.

This routine also handles calculations for lines partially off screen ensuring that the line eventually produced for the draw routine does not go off screen.

The routines to draw and delete figures use a draw routine specially written for this program which is extremely fast. The routine does not draw a line by plotting but by manipulating screen addresses and rotating a mask.

To use the plot/ routine for yourself use the following method:

Set up an unused figure e.g., fig 15 by Poking both DrawS and DrawP with the same value, the address of an unused area

of memory. Next Poke STFLG with 255. Store your plots and draws at this address in the following form:

P,x,y where P=0 to plot at x,y

point plotted to x,y P = 255 to end the data

x is a normal x co-ordinate Y has the range 0-191 where 0 is the bottom line of the edit area.

e.g. To draw a frame around the screen the data would be: 0,0,0, 1,255,0, 1,255,191, 1,0,191, 1,0,0, 255

Type program A into your computer and then Save it. Never try to run this program without the 3D machine-code routines in memory. For the 3D routines type in program B and then Save it. Now try running it. If an error is reported correct your error, resave the program and try again. Once the program has run successfully save the code as instructed in line 9999.

You now no longer need program B. You now have a machine-code program saved as code and a Basic program. Do not try and run the machine code without a valid set of parameters and data in memory. To see the various demonstrations load up with the Basic and then the code and then Goto 5000. Or to store an image type Run.

P = 1 to draw from the last Program A. REM "Data Storage Program" CLS : CLEAR 39999 REM 5 LET fi9=0: REM "Figure 0-15 10 LET addr=40000: REM "data storage address" 15 LET No=16: REM "Number of sets of data" 16 GO SUB 17: STOP 17 LET store=65032+fi9*20: POK store, No: LET addr1=store+1: L ET c=addr: GO SUB 500 18 LET addr1=addr 20 FOR f=1 TO No 30 READ x,y,z,P 40 LET c=x: GO SUB 500 45 LET c=y: GO SUB 500 50 LET c=z: GO SUB 500 55 POKE addr1,P 60 LET addr1=addr1+1 75 NEXT f 80 LET spare=12*(No+1) 82 LET free=spare+addr1 85 LET c=addr1: LET addr1=stor +15: GO SUB 500: LET c=spare/2+ : GO SUB 500: POKE addr1.0 95 PRINT "Data stored for figu e+15:

";f19 100 PRINT "data at ";addr 105 PRINT "next free memory at ";free 110 PRINT "Parameters at ";stor ;;" to ";store+19 120 RETURN 500 IF c<0 THEN LET c=65536+c 505 POKE addr1+1, INT (c/256) 510 POKE addr1, INT (256*(c/256-INT (c/256)))
515 LET addr1=addr1+2
520 RETURN 999 REM cube data 1000 DATA 20,-20,20,0,20,-20,-20, 11,-20,-20,-20,1,-20,-20,20,1,20, -20,20,1,20,20,20,1,20,20,-20,1,-20,20,-20,1,-20,20,-20,1,20,20, 20,1,20,-20,-20,0,20,20,-20,1,-2 0,-20,-20,0,-20,20,-20,1,-20,-20 ,20,0,-20,20,20,1 4997 REM 4998 REM Demonstration 4999 REM 5000 RESTORE : LET fig=0: LET ad dr=40000: LET No=16: GO 3UB 17 5010 RESTORE : LET fig=1: LET ad dr=free: GO SUB 17: RESTORE : LE T fi9=2: LET addr=free: GO SUB 1

5011 POKE 63501,10: CLS : POKE 64976,1: RANDOMIZE USR 63500: PO KE 64976,0: RANDOMIZE USR 63500: POKE 64976,2: RANDOMIZE USR 635 5012 FOR f=5 TO 95 STEP 10: POK E 63501,f: RANDOMIZE USR 63500: NEXT 4 5015 FOR f=65081 TO 65086: POKE f.0: NEXT f 5016 POKE 63501,10 5019 POKE 65075,40: POKE 65079,2 00: POKE 65036,0: POKE 65056,0: POKE 65038,0: POKE 65037,0: POKE 65058,0: POKE 65057,0: POKE 650 39,150: POKEEE 65040,0: POKE 65059 20: POKE 65060,0 5020 FOR f=170 TO -170 STEP -30: LET c=f: LET addr1=65035: GO SU B 500: LET addr1=65077: GO SUB 5 00: LET c=-f: LET addr1=65055: G 0 SUB 500: LET 9=ABS (f): POKE 6 5041,9: POKE 65063,9 5025 FOR h=0 TO 2: GO SUB 6000: NEXT h 5040 NEXT f 5041 RANDOMIZE USR 63500: GO TO 5015 6000 POKE 64976,h: RANDOMIZE USR 64234: RANDOMIZE USR 64679: RAN DOMIZE USR 64692: RETURN

Program B.

10 DATA "3e0afefa38023efa06004 f21fe00c5e5dde1e5cdd7fae5d5c5edb 0dde5e122d8fd22defd22dcfd22dafd1 1ff00ebed52cb3ccb1dcb3ccb1d22d4f d22d6fdc1e1d1edb0cdeafacda7fccdb 4fce1c1ed427ccb7f2008fe0020b579b d38b1fbc9c1c1c9c5ed"

11 DATA 16344

20 DATA "4beffdc53ebf9038f2cdb 02247043e010f10fde5d9e1d908e1c1e d43effd11010178943004ed4416ff477 9953004¢d441¢ff4fb8300969d5d9d1d 9af5f180bb128666841d5d9d1d916006 0781f853803bc3807944fd94b4218044 fd5d9c1cb402829cb78"

21 DATA 11938

30 DATA "20153e07a4280325181d2 57dd6206f38167cc608671810243e07a 4200a7dc6206f38047cd6086708cb412 80ecb7920060f30072c18040730012d4 700b6777808d97910a5c9fdcb45862a0 5fe110001ed52ed5bd8fd19cb7cc43df afd7e452205fe22e5fd"

31 DATA 91400

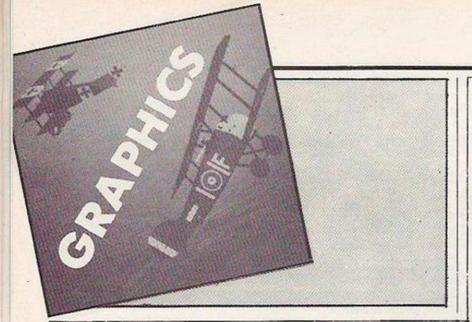
40 DATA "2a01fe2929ed5bd4fd19f 5cd6af9118000cda1f92201fe2a03fe2 929ed5bd6fd19f1fd7745cd6af911570 0cda1f92203fec9cb7cc43dfaeb2ae5f de5ed52e13801eb444daf08af086f67c b38cb19200508b9280b08300319ce00e b29eb18eb08300319ce"

41 DATA 12206

50 DATA "00456c67c9ebfdcb45462 8**0619fdcb45**86**c**9ed52c9e57cb52814c df9f922f3fde1cd05fa22f1fd21f1fd0 10400c9e13e8032f1fd21f1fd010100c 92adcfdcdb1f911f5fdedb02adefdcdb 1f911f9fdedb02adafdcdb1f911fdfde db0c9015a0009016801"

51 DATA 14865

(Program B continued on next page)



(program B continued from previous page)

60 DATA "ed42300109af3c01b400e d4230023d09011afd0956eb6fc9fdcb4 7462808dd6e03dd7e021806dd6e01dd7 e00260022e5fdfd7745ebcd6af9fdcb4 546c8af575febed52fd3445c9ddcb007 ec0c5cd18fafd3447d1e5cd18fad1fdc b4746280319afc9ebed"

61 DATA 12663

70 DATA "52afc9dd21f5fded5b01f eed4b05fefdcb47c6cd47fa2013ed5b0 1fe2201feed4b05fecd47fa2205fe444 ddd21fdfded5b03fefdcb47c6cd47fa2 011ed5b03fe2203feed4b05fecd47fa2 205feed4b03fedd21f9fded5b01fefdc b47c6cd47fac0ed5b01"

71 DATA 14664

80 DATA "fe2201feed4b03fecd47f a2203fec93ad0fd2108fe11d1fd01140 0a7c8093d20fcc9cdd7faedb03ae4fda 720083eff2b772ae0fd77af3207fecdd 7f9ed5be2fd3ad1fd472ad2fdc5d55e2 356ed5301fe235e2356ed5303fe235e2 356ed5305fe23e5cd67"

81 DATA 13798

90 DATA "facd19f9e17e23d1e5f5d 53a07fe4f2a01feed5b03feafb4b2200 73ebfbb3e0030023e013207feb1201b2 2ebfded53edfdc1f102037d02037b020 35950e1c110a23eff12c97ca7280b3ae cfda72805ac17d29bfc7aa7280d3aeef da72807aa17d29bfc18"

91 DATA 12207

100 DATA "0d7bfec038083aedfdfec 0d29bfce5d5e52aedfda7ed5222e7fdd 12aebfda7ed5222e9fdebed5b03fecde 9fbe5d52aebfded5bedfdcde9fb6322e 9fdd1e1c1ed43edfdc1ed43ebfdc1af0 2033ae9fd02033aeafd0203c35efbd5c b7c2806cd47fc210000"

101 DATA 16381

110 DATA "7ca7280c11ff00a7ed52c d47fc21ff00e52ae9fded5be7fded53e 9fd22e7fdd1e1d5cb7c2806cd47fc210 0007ca720057dfec0380c11bf00a7ed5 2cd47fc21bf00e52ae9fded5be7fded5 3e9fd22e7fdd1e1c9fdcb4586ed5be7f dcd8dfc6568ed5be9fd"

111 DATA 15420

120 DATA "cd63fcc1d1cda1f9e5c5c 9ebcb7cc487fceb7ab32815010000a7e d5238030318f91929ed523801036960c 9210000c9d5cd3dfad1c9cb7cc487fce bcb7cc487fcc373f922ebfded53edfdd 1f1c369fbcdf6fce50e2f06a62ae0fd1 816cdf6fce50e0006b6"

121 DATA 14795

130 DATA "2ae2fded5be0fd22e0fde d53e2fded430ff9d9e5d97e23feff281 24e234623e51f3804ed43effdcd6ef8e 118e8d9e1d9d121e0fd010400edb0c9c dd7fa010f000911e0fd010500e5edb03 ae4fda7200c2b3eff772ae0fd772ae2f d77e1c90004080d1116"

131 DATA 13804

140 DATA "1a1f23282c3035393d424 64a4f53575b5f64686c7074787c7f838 78b8f92969a9da1a4a7abaeb1b5b8bbb ec1c4c6c9cccfd1d4d6d9dbdddfe2e4e 6e8e9ebedeef0f2f3f4f6f7f8f9fafbf cfcfdfefefffffffffffffffffffff efefdfcfcfbfaf9f8f7"

141 DATA 18475

150 DATA "f6f4f3f2f0eeedebe9e8e 6e4e2dfdddbd9d6d4d1cfccc9c6c4c1b ebbb8b5b1aeaba7a4a19d9a96928f8b8 783807c7874706c68645f5b57534f4a4 6423d3935302c28231f1a16110d08040 00000"

151 DATA 10715 4990 CLEAR 59999

5000 LET c=0: LET f=63500 5010 FOR h=1 TO 15: READ as

5020 FOR s=1 TO LEN a\$ STEP 2 5030 LET a=CODE a\$(s): LET b=COD

E a\$(s+1)

5050 IF a>96 THEN LET a=a-39 5060 IF b>96 THEN LET b=b-39

5070 LET a=a-48

5080 LET b=b-48 5090 POKE f,a*16+b

5091 LET C=C+PEEK f

5100 LET f=f+1

5110 NEXT s

5111 PRINT h

5120 READ tot: IF tot<>c THEN P RINT "Error at line ";h*10: STOP

5125 LET c=0

5130 NEXT h

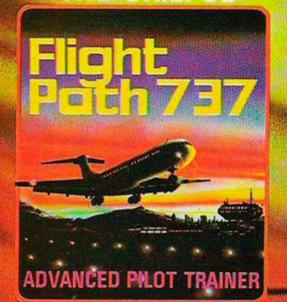
5131 REM

9999 CLS : BEEP .2.0: PRINT "COD E STORED CORRECTLY": PRINT "SAVE CODE 63500,1478"



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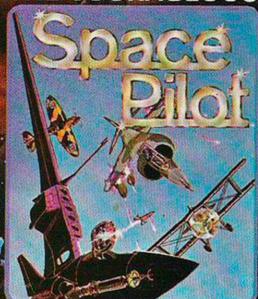


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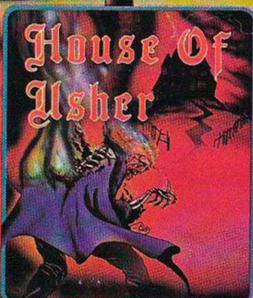
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lan Briscoe's program will extend the graphics capability of your Spectrum.

Table 1. The Control codes

CHR\$ 0;CHR\$ n; Selects a window. n must be in the range 0 to 7.

CHR\$ 1;CHR\$ tix;CHR\$ tiy;CHR\$ brx;CHR\$ bry. Defines a window's size. Top left x, top left y, bottom right x, bottom right y.

CHR\$ 2;CHR\$ n; Scrolls. In the window map there are two scrolling registers. This scrolls the current window according to these registers, n is the number of times the operation is to be done.

CHR\$ 3;CHR\$ n; Scroll window left n times. Preserves the scroll registers.

CHR\$ 4;CHR\$ n; As above but for right. CHR\$ 5;CHR\$ n; As above but for up.

CHR\$ 6;CHR\$ n; As above but for down. WARNING. CHR\$ 6 is the comma in PRINT statements. Any attempt to use PRINT comma will result in a down scroll.

CHR\$ 7;CHR\$ byte;CHR\$ value; Window map poke. There are 45 bytes in a window map, see table 2, numbered 0-44. This enables those bytes to be changed easily.

CHR\$ 8; Back cursor.

CHR\$ 9; Forward cursor.

CHR\$ 10; Down cursor.

CHR\$ 11; Up cursor.

CHR\$ 12; Delete. CHR\$ 13; Newline.

CHR\$ 14;CHR\$ routine + mode;CHR\$ x;CHR\$ y; This is the plot command and is a lot like the Beeb's. See table 3.

CHR\$ 15; COPY the whole screen to the ZX printer.

CHR\$ 16;CHR\$ ink; Define text ink. PRINT INK n; will work but is not temporary.

CHR\$ 17;CHR\$ paper; As above but for

CHR\$ 18;CHR\$ flash; As above but for flash.

CHR\$ 19;CHR\$ bright; As above but for bright.

CHR\$ 20;CHR\$ over; As above but for OVER.

CHR\$ 21;CHR\$ inv; As above but for INVERSE.

CHR\$ 22;CHR\$ x;CHR\$ y; Same as PRINT AT y,x but note the x and y are the opposite way around to Sinclair AT control code.

CHR\$ 23;CHR\$ tab; Changes the current x co-ordinate to "tab"

24;CHR\$ oldink;CHR\$ newink; Window instant ink change.

Changes any oldink into newink.
CHR\$ 25;CHR\$ oldpaper;CHR\$ newpaper; As above but for paper.

CHR\$ 26;CHR\$ bright; Window actual bright set/reset.

CHR\$ 27;CHR\$ flash; Window actual flash set/reset.

CHR\$ 28;CHR\$ width;CHR\$ height; Like the CSIZE command on the QL. Defines the width and height of the large characters. See table 2 for more information.

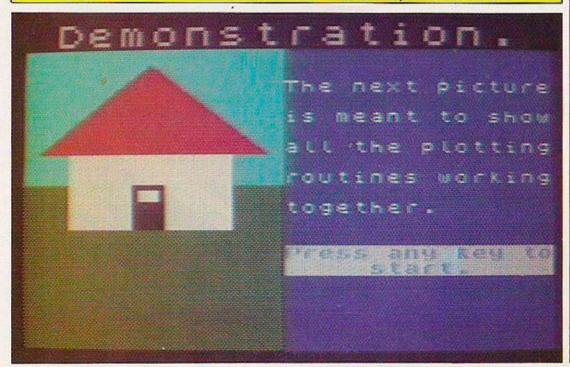
CHR\$ 29; In the window map there is an address which tells all the WINDOS routines where the start of the screen is. If this were changed, then any output would not be seen. A Dragon-like invisible screen will be present. So to get the data from the screen memory to the actual display memory, use this command.

CHR\$ 30; Home cursor.

CHR\$ 31; Clear the current window.

NOTES

There is no graphics windowing. CLS uses the print routine. There is normally a visible cursor.





EVER SINCE THE SPECTRUM was launched, other computers have been brought on to the market with better graphics capabilities.

So, feeling that the Spectrum could do with some added graphical muscle, armed with my 48K Spectrum with Microdrive and Hisoft's excellent Devpac, a highly recommended package, I set out to give the Spectrum all these facilities and more. The result is Windos, a 5K program packed with practically every feature you could wish for. A whole book could be written describing all the possibilities, but the main functions are:

32- or 64-column windowing.

Four-way window scrolling.

An extended plot function.

Instant colour changes.

Large letters in any of four orientations.

An intelligent paint/unpaint.

An alternative screen at any address.

To get Windos up and running, type in listing I and Save it a few times, then Run it. Once Run successfully, the code will be automatically saved.

Owners of Microdrives may wish to change the appropriate lines to enable saving to cartridge.

Most experienced Spectrum users will be familiar with the concept of streams and channels. What I have done is to alter the channel 3 output routine vector, found in the channel information area, and make it point to my own output routine.

This means that the ZX Printer is now disabled.

LPRINTS, OPEN # 2, "p"

can be used to enable Print. However, how can this be of any use for accessing the routines? BBC users are used to the VDU statement on their micro, but this can be replaced by:

PRINT CHR\$ n; CHR\$ n; etc

to achieve the same effect. Well, this is exactly how the routines are accessed, via control codes. Of course, most of the codes are different from the BBC's and have a different number of parameters - see table 1 for a complete run-down. Now back to the original (continued on page 103)



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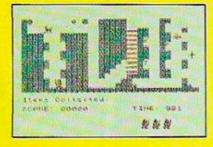
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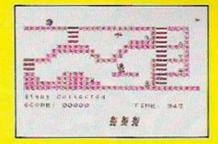
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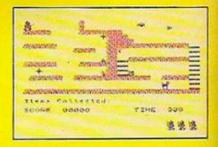












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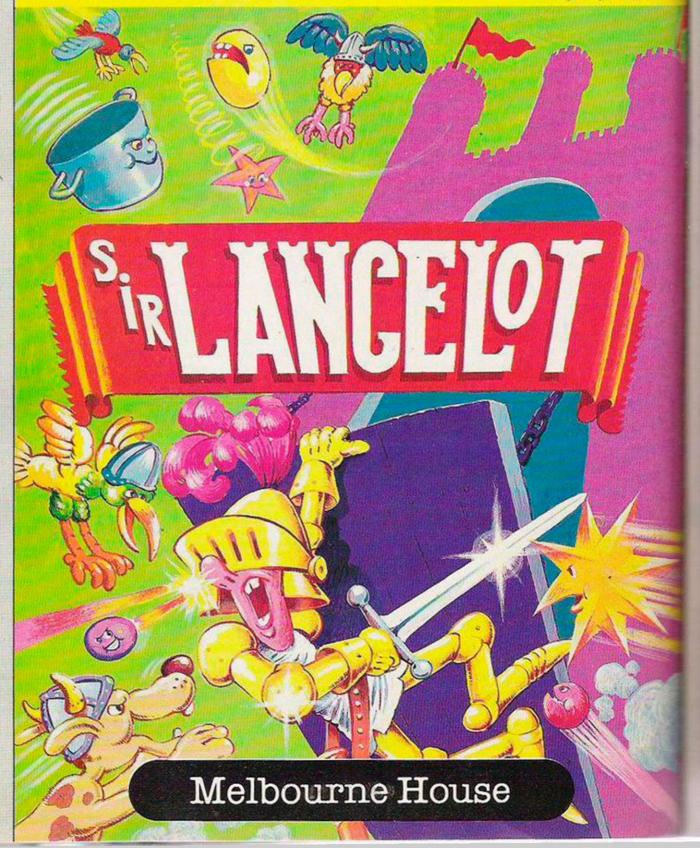


Table	2. The window map.	33
Byte	Meaning.	34
0-3	The window size as set up and in	35
	the same order as CHR\$ 1; etc.	36-3
4	The text colour.	NEVEN
5	The graphics colour.	38
6-7	The text co-ordinates, with 0,0	
	being at the top left of the window, NOT the screen.	
8-9	The last x,y specified by CHR\$ 14;	20
10-11	Used internally.	39
12	Text flags. See table 4.	
13	Graphics flags. See table 5.	
14	The attribute used by the cursor,	
	so the cursor can be flashing or not.	
15-29	The parameter queue. See next month's article for more details.	
30	Current control code.	40
31-32	Next free space in queue, as an	41
	address.	42

33	Number of parameters to come before execution,
34	Width of large characters.
35	Height of large characters.
36-37	Second to last point specified by CHR\$ 14:.
38	Draw pattern. Like the Oric PATTERN command. This is the bit pattern that draw uses to do dotted lines. Normally 255 for solid lines.
39	Text attribute mask. As there is no eg. PAPER 8 allowed, this is used to achieve the same effect. Every bit of this byte that is set means that the equivalent bit of
	the old attribute to be obliterated

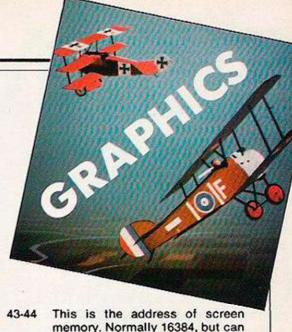
by printing will not be destroyed.

So to achieve INK 8 set this byte

to 7, PAPER 8 is BIN 111000 etc.

As above but for the attributes.

As above but for graphics. The pixel scroll register.



memory. Normally 16384, but can be changed. Normal Intel format applies, ie. LSB first followed by the MSB.

(continued on page 107)

```
Listing 1.
Listing 1.

10 REM Loader for UINDOS.
30 REM UILLET by Ian Brascos.
10 REM 4:90s1 1994.
50 REM
60 REM 6:90s1 1994.
50 REM
60 CLERH ESSSS
80 LET ::ne:1000
90 RESTORE 1000
100 LET address =80000
115 LET address =80000
115 LET address =80000
110 90 SUB SOC
110 POR sell TU 08
130 GO SUB SOC
110 PRINT 'Code in memory.'
130 PRINT 'Insert free tape...s
7615 any keyto start...
200 PAUSE 0 PRINT 'SAUEing "L
0ADERIL"
210 PRINT 'Again 7 (//N) "
220 LET a=80 COD sells! THEN GO TO
240 IF a (78 AND sells) THEN GO
250 PRINT 'Insert free tape...p
260 PRINT 'Again 7 (//N) "
```

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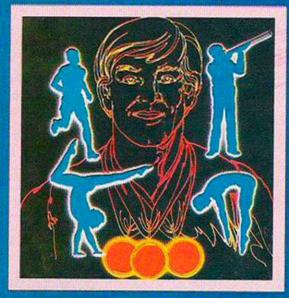
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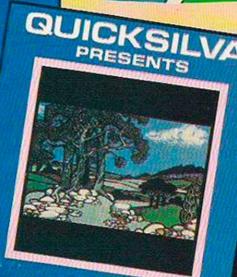
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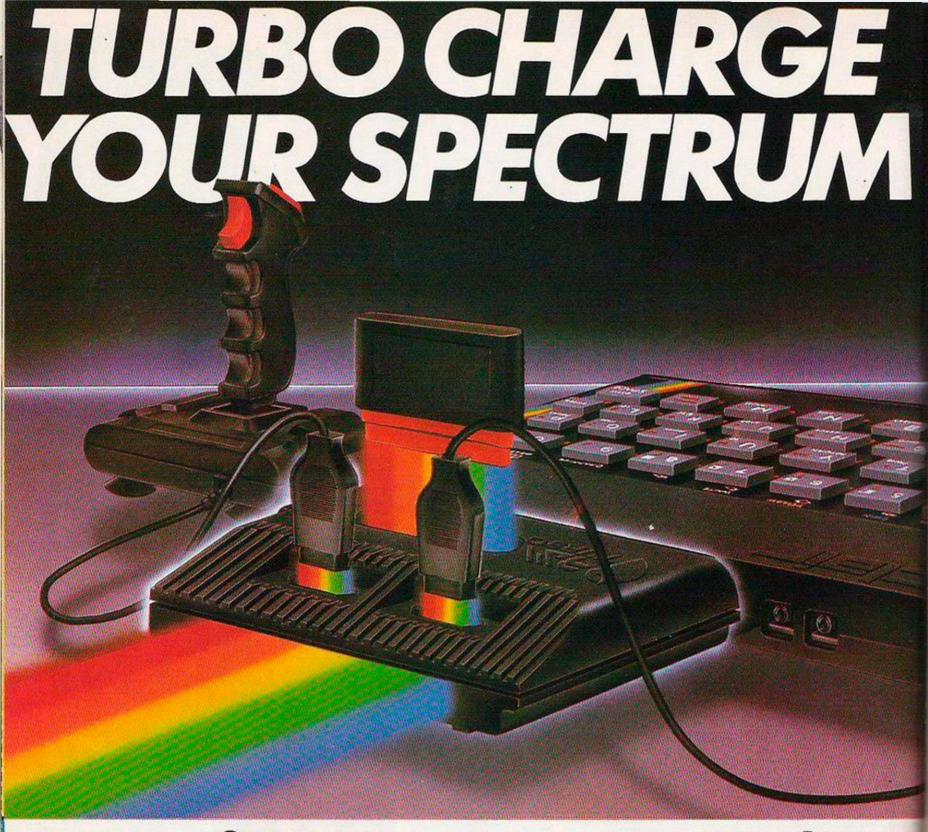
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(continued from page 103)

question. To get Windos into operation, first initialise channel 3 by using

RANDOMIZE USR 60000

However, this won't clear the system's own variables area which holds the attributes for all 8 windows, each "window map" as I call them, being 45 bytes long, so use

RANDOMIZE USR 60003

to initialise it. More information about the window map can be found in table 2.

Now you can begin to use the system. Type

the many effects possible.

system works inside.

1 = XOR or OVER plotting.

2 = UNPLOT.

Kent ME15 7QY.

Plotting routines

0 = Normal OR plotting.

3 = MOVE.

0 = PLOT. An ordinary dot plot.

4 = DRAW. Draw a line to x,y. Note that

in the demonstration program to see some of

Once fully understood, I hope that you will

The last part of the series will give Interface

1 owners an Extended Basic to use the system

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to Ian Briscoe, 32 York Road, Maidstone,

begin to realise the possibilities the system offers. Next month, I will explain how the GRAPHICS. the origin

is in the top left corner.

8 = PAINT. Fill in enclosed area. This is an intelligent fill so make sure there is at least 0.5K between Ramtop and your program as the machine stack is used as workspace.

12 = BOX. Draws a triangle using the last and the second to last points plotted as two of the three points, the third being the point specified.

16 = TRIANGLE. Draws a triangle using the last and the second to last points plotted as two of the three points, the third being the point specified.

20 = FILLED BOX. Like BOX only filled. Like the other shape routines, the draw routine is used so if a draw pattern, see table 2, byte 38, is in use then there will be a textured box.

24 = SET. Just sets the plotting mode and the graphics co-ordinates.

Table 3. The plotting routines and modes.

When using the plot command, CHR\$ 14, the first parameter is the routine added to the plotting mode. They are as follows:

Plotting modes.

Table 4. The text flags. Meaning.

0-1 00 = Normal over printing. 01 = XOR or OVER 1 printing.

10 = Inverse printing.

11 = OR printing.

Scrolling suppression.

0 = Normal scrolling when the cursor tries to go too far up, or too far down.

1= A Lynx-type wraparound window.

Attribute suppression.

0 = Old attributed destroyed.

1 = Old attribute left unchanged.

'Form feed' suppression.

0 = Normal newline.

1 = Cursor stays on the same line. Output selection.

0 = Normal 32 or 64 column windowing.

1 = Large letters. To print large letters, this bit must be set.

32/64 column selection.

0 = 32 column windows and printing.

1 = 64 column windows and printing.

Cursor switch.

0 = Cursor on.1 = Cursor off.

It is useful when working at bit level to use the BIN functions.

REM UINDOS Demonstration REM written by Ian Briscoe REM August 1984 REM CLEAR 59999
GO SUB 1000
GO SUB 1001
GO SUB 1001
GO SUB PICTURE1
GO SUB PICTURE2
GO SUB END
STOP 1016
1020 LET text1=8000
1030 LET text2=4000
1040 LET picture13000
1050 LET picture2=5000
1052 LET end=5000
1054 LET codes=7000
1056 LET strings=8000
1057 LET toad=9000
1058 POKE 23593.71: BORDER 0: CL 1050 INPUT "Have you got WINDOS in memory? ": LINE as 1070 IF as="y" OR as="Y" THEN GO TO 1090 NETURN

RETURN

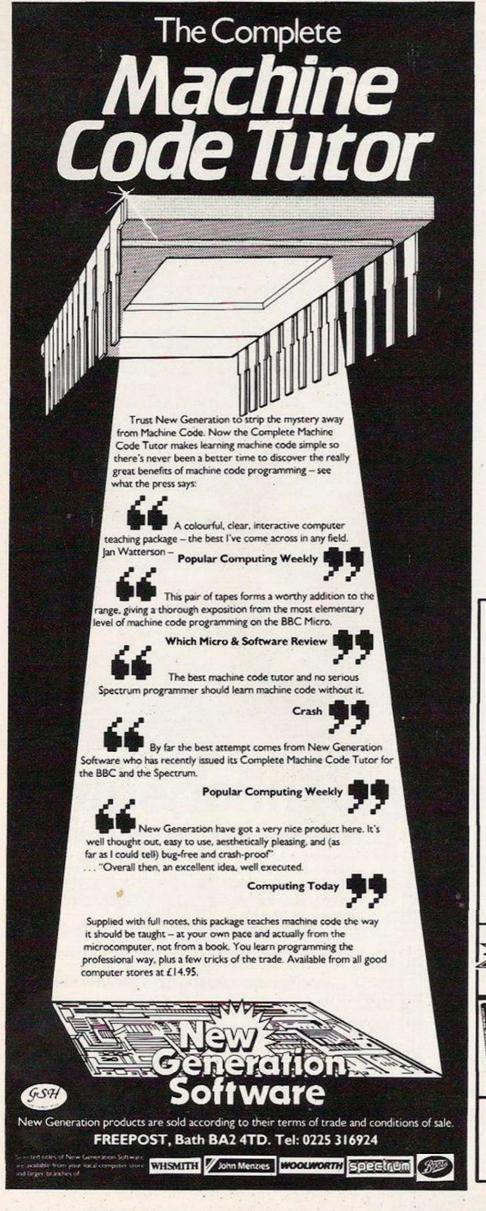
2010 REM Text routine 1.
2020 REM
2030
2040 RESTORE 2900
2040 GO SUB strings
2110 RETURN
2905 REM Number of string
2907 DATA 9
2909 REM Text
2911 DATA CHEE 20000 2010 REM 102 PEM 2030 2040 RESTORE 2000 2060 GO 3UB strings 2110 RETURN 2005 REM Number of strings. 2007 DATA 9 2009 REM TEXT 2011 DATA CHRS 0+CHRS 0+CHRS 31 2012 DATA "This is a small demonstration"-CHRS 13 2014 DATA "Of what is possible with the new *CHRS 13 2014 DATA "Ot what is possible with the new *CHRS 13 2016 DATA "Ot what is possible with the new *CHRS 13 2016 DATA "Ot but foutine."+CHRS 13 2016 DATA "Ot but foutine."+CHRS 13 2016 DATA "CHRS 13 2016 DATA "Ot but foutine."+CHRS 13 2016 DATA "CHRS 13 2020 DATA "CHRS 13 2020 DATA "CHRS 13 2020 DATA "CHRS 13 2020 DATA "Number 10 2010 PEM 2010 P REM Picture 1. RESTORE 3900 GO 5UB COdes RETURN 3100 RETURN
3110 REM Length of data.
3902 DATA 83
3904 REM Select window 1.
3908 DATA 83.
3904 REM Select window 1.
3908 REM Define graphics colour.
3910 DATA 7,5,BIN 100
3912 REM Move to 128,88
3914 DATA 14,3,128,88
3915 REM Set the draw pattern.
3913 DATA 7,38,BIN 10101010
3920 REM Draw a filled box to
3920 DATA 14,20,254,175
3924 REM Reset draw pattern. 254.175
3922 DATA 14.20,254.175
3924 REM RESET draw Pattern.
3926 DATA 7.38.255
3928 REM Change Colour.
3930 DATA 7.5.81N 01111000
3932 REM MOVE to 152.64
3934 DATA 14.3.152.64
3938 REM UNIT 14 abox to
231.111
3939 REM MOVE to 184.88
3941 REM DATA 14.2.231.111
3949 REM MOVE to 184.88
3941 REM DATA 14.3.186.90
3944 DATA 14.3.186.90
3944 DATA 14.3.186.90
3945 REM DATA 14.3.186.90
3945 REM DATA 14.3.186.90
3947 REM FILL the door.
3948 DATA 14.12.199.11
3953 REM MOVE to 186.90
3949 REM SEM 150.90
3959 DATA 14.3.198.98
3959 DATA 14.3.198.98
3959 DATA 14.3.198.98
3959 DATA 14.3.198.98
3959 DATA 14.3.247.71
3955 DATA 14.3.247.71
3955 DATA 14.3.247.71
3955 DATA 14.3.247.71
3956 REM DATA 14.3.247.71
3957 TATA 14.5.192.24 3957 DATA 14,15,192,24

3950 REM Fitt the triangle, 3959 DATR 14.8,192.50 3960 REM Set the scrotting registers, 3961 DATR 7,41,8IN 110100,7,42.8 IN 110100 3962 REM Scrott 240 times, 3963 DATR 2,240 3965 DATR 0,0 3965 REM Setect window 0 3965 REM Clear screen 3967 DATR 31 4000 REM 4010 REM Text 2, 4020 REM 4100 RETURN
4110 REM Number of Strings.
4301 DATA 13
4304 REM SCROLL PICTURE INTO
WINDOW 0.
4305 DATA CHRS 0+CHRS 3+CHRS 7+C
HRS 1+CHRS 2+CHRS 7+CHRS 41+CHRS
BIN 1101100+CHRS 7+CHRS 42+CHRS
BIN 10110100+CHRS 7+CHRS 42+CHRS
BIN 10110
4306 DATA CHRS 2+CHRS 16
4300 REM Select Window 1.
4310 DATA CHRS 0+CHRS 1
4312 REM DEFINE THE COLOUR.
4314 DATA CHRS 7+CHRS 10
4316 REM CLEAR WINDOW 1.
4316 REM CLEAR WINDOW 1.
4316 REM CHRS 31+CHRS 10
4320 REM Start Printing.
4321 DATA
4326 DATA "THE NEXT PICTURE"+CHR
513
624 DATA "IS BEANT TO SHOW"+CHR
513 \$ 13 4826 DATA "all the plotting"+CHR \$ 13 4828 DATA "routines working"+CHR 1020 DATA "together," there is 4030 DATA "together," there is 4030 DATA CHRS 13+CHRS 13+CHRS 7 +CHRS 14+CHRS 51N 11001111 4834 DATA "Press any key to"+" start.

5000 REM Picture 2.

5020 REM 5020 REM 5030 PRINTED P PAUSE 0 RESTORE 5800 GO 5UB codes PRINT " Press any key."; RETURN S120 PETURN
5130 RETURN
5130 REM Length
5802 DATA 103
5804 REM 3elect window 3 and
define it.
5806 DATA 0, 3, 7, 4, 86, 1, 0, 2, 31, 23
5808 REM Define graphics colour,
and altibute mask.
5810 DATA 7, 5, 35, 7, 40, 81N 111110
8012 REM Start drawing, Follow
the steps through to see
how each effect is made.
5814 DATA 14, 3, 10, 17
5816 DATA 7, 8, 81N 11001100
5818 DATA 7, 8, 81N 1201100
5819 DATA 7, 3, 255
5820 DATA 14, 3, 150, 25
5822 DATA 14, 3, 150, 25
5824 DATA 14, 10, 100, 75
5826 DATA 14, 3, 250, 50
5828 DATA 14, 3, 110, 110
5832 DATA 14, 12, 285, 180

5834 DATA 14,3,1,16,7,38,8IN 111 10000 5836 DATA 14,21,255,191 5838 DATA 7,38,8IN 00001111 5840 DATA 14,3,1,16,14,21,255,19 5842 DATA 7,38,258 5844 DATA 14,3,0,16,14,22,258,19 1 5845 REM Set UP the large letters Bode, size, direction and position. 5846 DATA 7, 12, 160, 25, 2, 10, 7, 13 0, 14, 24, 0, 45 6000 REM End. 5020 REM End. 5020 REM 6030 6035 PAUSE 0 6040 PRINT PAPER 0; INK 6; CHR\$ 3 6042 PRINT CHRS 28, CHRS 1; CHRS 2 0043 LET ink = 0 7 CHR\$ 13 CHR\$ 2 6045 PRINT CHR\$ 24 CHR\$ 13 CHR\$ 0 1 CHR\$ 14 CHR\$ 24 CHR\$ 120 CHR\$ 60 60 CHR\$ 14 CHR\$ 25 CHR\$ 1 CHR\$ 12 CHR\$ 17 CHR\$ 27 CHR\$ 12 CHR\$ 17 CHR\$ 27 CHR\$ 12 CHR\$ 27 CHR\$ 5049 FOR b=1 TO 30 5050 FOR 3=1 TO 7 STEP 2 6055 FOR 3=1 TO 7 STEP 2 6055 PRINT CHR\$ 24; CHR\$ a; C HR\$ (a+1); 6050 NEXT a 5070 POR a=0 TO 5 STEP 2 5075 PRINT CHR\$ 24; CHR\$ a; C HR\$ (a+1); 6080 NEXT a 6090 NEXT a 5075 PP HR\$ (8+1) REM Code printing.
REM PEAD Length
FOR a=1 TO Length
READ data
PRINT CHR\$ data.
NEXT a
RETURN 3000 REM 3002 REM String Printing. 3004 REM 3005 REM READ length FOR a #1 TO length READ as PRINT as. SO14 NEXT & SO16 RETURN REM Load in WINDOS. REM 9030 RETURN
9030 RETURN
9030 RETURN
9030 RETURN
9030 RETURN



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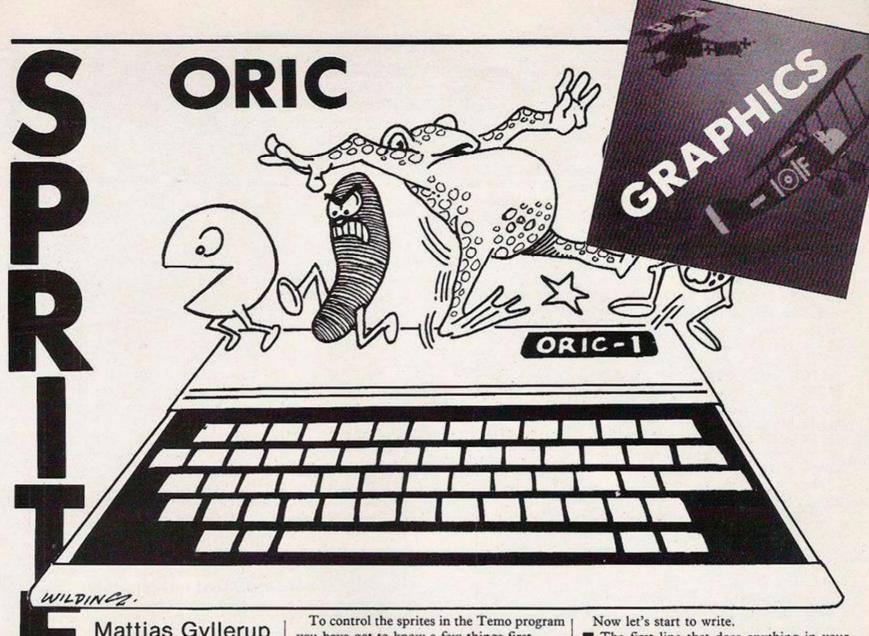
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Mattias Gyllerup with a short sprites program together with a demonstration of what it can do.

THIS IS A sprite program for the Oric-1 48K, but I believe that it would suit the Atmos as well. The Temo - Test Mode - sprites will only work in Text mode, but still give you the effect of one pixel movement in every direction. Each sprite is made by a 6×8 grid - one character — but needs a 12×24 grid — four characters — to work, eg. One sprite would easily fit into the character C, but to work it must also use D,E and F. This technique consumes a lot of memory, but it is the only way it can be done.

Line 0 to 300 is a demo program with only one sprite in action. The description of how to use the sprites will refer to this program.

Line 500 to 870 shows you 20 sprites in action. Run 500 will allow you to look at this small demo program. To get back to the ordinary character set, press the Reset button.

Line 60000-60450 is the Temo machine code. When you are about to make your own program using sprites then only type in these lines, and then type in your program, which must - of course - contain a Gosub to 60000

Remember that the Gosub must be after your Data statements, if you use any.

you have got to know a few things first.

If the sprite is on (1) or off (0) — ON/OFF

■ The Y and X coordinates of the sprite -YPOS & XPOS status.

The address to the first character in your sprite eg. If you choose the characters A,B,C,D to represent your sprite, then the address to the first byte of "A" is address to the first byte of "A" is important — ASCII pointer status.

The ASCIIcode of the first character in

your sprite. If you choose same as above, then the ASCIIcode of "A" is important — ASCIIcode status.

The address to the first byte of your defined sprite - Spritepointer status.

THE ADDRESSES TO THE STATUSAREA Status name ON/OFF Basic address 38912-39011 Uses byte YPOS 39012-39112 byte **XPOS** 39112-39211 byte ASCIIPOINTER SPRITEPOINTER 39212-39311 2 bytes 2 bytes 39712-39811 ASCIICODE 39812-39911 1 byte

Although some status only uses 1 byte to store their content, they are made of 2 bytes. But it's only the low byte that is poked. And at last, a very important address: 105. This address indicates how many sprites, from the first sprite, that you use. The value 2 means the first 2 sprites, 15 means the first 15 sprites.

You can have a value between 1 and 49. Zero or greater than 49, will turn the program

This makes it possible for you to store 49 sprite statuses. But because of the character limitation - only 92 useable characters divided by four, makes a total of 23 sprites the sprite number will decrease. But if you are a whizkid, then perhaps you could learn how to make use of the other 26 possible sprites.

The first line that does anything in your program will look like this:

0 HIMEM 38900

This line prevents the Temo program and the status area to be overwritten by the Oric variable area

Before creating the status area, we must clear it.

10 FOR F = 38912 TO 40011

20 POKE F,0 30 NEXT F

Now let's choose the sprites to work with. I choose to work only with sprite 5. Don't bother about the number, I just chose it.

40 N = 5 50 POKE 105,N

I have to poke address 105 with N(5) only because the program have to run through the five first sprites to find my sprite. As you can see, it would be faster if I had chosen sprite 1, but this is just a demo to show you the main

Now we must define the sprite, and place it somewhere in the memory. I decided to place it at address 38892-38899. I could have placed it anywhere else. But now I see a problem. I have to decrease the Himem, so that the sprite codes won't be overwritten by the variable area. So I change row 0 to:

0 HIMEM 38892

And to define the sprite and place it at memory location 38892-38899.

60 FOR F = 38892 TO 38899

70 READ A 80 POKE F,A

90 NEXT F 100 DATA 18,12,30,45,45,30,18,0

The Data values are taken from the Oric manual page 89. As you can see, the sprite has (continued on next page) (continued from previous page)

the same size as an ordinary character. But it takes four characters to poke the sprite onto screen. So on every characterised sprite, Temo will use four character. That's why the total amount of sprites, only is 23. I know that it's a waste of memory, but it's the only way to get a four-way direction of the sprites.

To get the status address of sprite N, then use the following formula: Status Basic address + N×2-2=status address to sprite N. For example, we use sprite number 5, and want to know the address to On/Off status. The On/Off status Basic address is 38912. See "The addresses to the status area". 38912+5×2-2=38920. 38920 is the On/Off status address of sprite number 5. Let's set the status.

The On/Off status. The value 1 turns sprite on, value 0 turns sprite off:

110 POKE 38912 + N × 2 − 2,1

The YPOS status:

120 POKE 39012 + N × 2 - 2,15

The XPOS status:

130 POKE 39112 + N × 2 - 2,15

We now have positioned the sprite at 15,15.

■ The ASCIIPointer status: 140 DOKE 39212 + N × 2 - 2, 46080 + (8 × ASC("a"))

To receive the Doke value, we use another formula, found on page 85 in the Oric manual. The character is the first character that the sprite is made. I have chosen the character a,b,c and d to be used in my sprite. If you would like to use other characters then simply change the character between the quotationmarks. For example, if you would like to use the character T,U,V and W then change the line to:

140 DOKE 39212 + N × 2 - 2, 46080 + (8 × ASC("T"))

■ The sprite pointer status: 150 DOKE 39712 + N × 2 – 2,38892

The value 38892 is the address to the first byte of the sprite codes.

■ The ASCIIcode status:

160 POKE 39812 + N × 2 - 2, ASC("a")

The ASCIIcode of your first character. The character used here must be the same as in line 140. Remember: Try not to use the four characters, preserved for one sprite, in another sprite. It wouldn't look too good. Now all status have been taken care of.

Type:

170 DOKE # 2F5,40396

This operation defines a new command for the Oric. The Temo command.

! is the new command. See page 128 in the Oric manual. Now all necessities have been taken care of, so let's make a little routine to see what can be done with the Temo program.

190 FOR F = 1 to 20 200 Y = PEEK(39012 + N × 2 - 2,Y) 210 Y = Y + 1 220 POKE 39012 + N × 2 - 2,Y 230 X = PEEK(39112 + N × 2 - 2) 240 X = X + 1 250 POKE 39112 + N × 2 - 2,X 260 ! 270 NEXT F

This little routine moves the sprite around the screen. Experiment with different values to add in line 210 and 240.

280 POKE 38912 + N × 2 - 2,0

Turn sprite off.

290 !

Makes the sprite disappear. 300 END

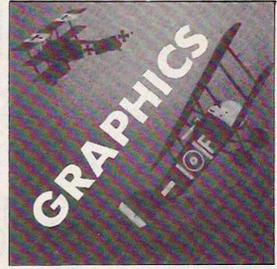
Don't clear the screen, if you don't want to miss the effect. Run, and watch the upper left corner of the screen. This program was written only for one sprite. Now it's your turn

to make use of the Temo sprites.

Study the program, and see how it's done. After a while you will have all addresses in your head, and then the use of the Temo sprites will be easier.

I hope that you understand, that the more sprites you use, the more Poking and Doking will have to be done.

To prevent a system crash the first line to be written in any of your programs is: line number Himem 38900



You can decrease the Himem value, but don't set the value to be greater than 38900. If you work with machine code, then you ought to know that zero page address 166 and 167 holds the Himem value, so that you don't have to operate in Basic, only because of the Himem.

The next lines to be written, if the status area only contains the value 85(# 55), is: line number FOR F = 38912 to 40011 line number POKE F,0 line number NEXT F

Don't enter Hires mode. The Temo will, after the first run, prevent this by Poking 704,0.

Don't use the commands Grab and Release. Don't Poke or Doke the memory blocks 38900-38911 and 40012-40620.

Check and double check your programs, and don't forget to Save them. You're allowed to Poke or Doke addresses 100-122, as these locations are used by the Temo program.

The character that you choose to be your sprite must be in succession, e.g., A,B,C,D or #,\$,%.&.

The Temo program will handle all sprites – depending on address 105 — when called.

If you don't want to use the Temo command !, then
CALL 40396

O HIMEH 38892
10 FOR F-38912 TD 40011
20 PORCE F,0
30 MEXT F
40 N-S
50 PORCE 105.N
60 FOR F-38892 TO 38899
70 READA
80 PORCE F,A
90 NEXT F
100 DATA 18,12,30,45,45,30,16,0
105 GOSUB 40000
110 FORCE 39912+N=2-2,15
130 FORCE 39912+N=2-2,15
140 DORCE 39912+N=2-2,45080+(8+ASC("a"))
150 DORCE 39912+N=2-2,46080+(8+ASC("a"))
150 DORCE 39912+N=2-2,46080+(8+ASC("a"))
170 DORCE 39912+N=2-2,46080+(8+ASC("a"))
170 FOR F=1 TO 200
200 Y=FEEK(39012+N=2-2)
210 Y=Y=1
220 PORCE 39012+N=2-2,Y
230 X=FEEK(39112+N=2-2)
240 X=X=1
250 PORCE 38912+N=2-2,X
260 ;
270 NEXT F
280 PORCE 38912+N=2-2,0
290 !
300 END
500 HIMEM 38900
505 FOR F=1 TO BIREAD AINEXT F:REM +ELIMINATES THE DA
TA VALUES IN LINE 100+
510 GOSUB 60000
520 FOR F=38912 TO 40011
530 PORCE 39912+F=2-2,1
570 NEXT F
580 C=0
590 FOR F=1 TO 20
600 PORCE 39912+F=2-2,C
610 C=C+12
620 NEXT F
625 Y=20
630 FOR F=1 TO 20
640 PORCE 39912+F=2-2,20
640 PORCE 39912+F=2-2,46080+(8=C)
660 C=C+4

60150 DATA 811,108,891,108,802,805,8,800,245,860
60160 DATA 887,0,8A0,8,891,108,8CB,8C0,32,9D0,249,860
60170 DATA 860,0,8B1,106,8B5,117
60160 DATA 860,881,110,8B5,119,860
60190 DATA 860,881,106,8B5,117,860
60190 DATA 860,881,868
60200 DATA 860,889,868
60200 DATA 860,855,108
60210 DATA 860,851,108
60210 DATA 860,865,108
60210 DATA 860,865,109,865,113,8A9,181,8B5,114,819,8A3,108,869,8,885,108
60220 DATA 8A0,0,8A5,104,891,106,8CB,8AA,8EB,8EB,8EB,8BA,891,106,860,40,8AB,8CA
60220 DATA 8A0,0,8A5,104,891,106,8CB,8AA,8EB,8EB,8EB,8EB,8BA,891,106,8A0,40,8AB,8CA
60220 DATA 8A0,0,8A5,116,891,106,8CB,8A5,118,891,106,8A0
60240 DATA 8A0,0,8A5,116,891,106,8CB,8A5,118,891,106,8A0
60240 DATA 8A0,0,8B1,120,991,108,8CB,8CD,8,8D0,247,86
60250 DATA 8A0,0,8B1,120,891,108,8CB,8CD,8,8D0,247,86
60260 DATA 8A0,0,8B1,120,891,108,8CB,8CD,8,8D0,247,86
60270 DATA 8A5,122,818,8A5,122,8AB,8A5,116,899,144,15
3,8A5,117,899,244,153
60300 DATA 8A0,0,8B1,120,28,8CB,117,899,189,154,860
60310 DATA 8A0,0,8B1,120,2,8B1,8A5,122,8AB,8A5,116,899,144,15
3,8A5,117,899,244,153
60300 DATA 8A0,0,8B1,122,2,8AB,8B9,0,152,8CP,0,0,8D0,1,800,8A9,0,8B2,122,8AB,8B9,0,152,8CP,0,0,8D0,152,8CP,0,8B0,1,8D2,8B1,152,8CP,0,8B0,1,8D2,8B1,152,8CP,0,8B0,1,8D2,8B1,152,8CP,0,8B0,1,8D2,107,8B9,11,152,8CP,0,8D0,152,8CB,107,8B9,11,152,8CP,0,8D0,152,8CB,107,8B9,11,152,8CP,0,8D0,152,8CB,107,8B9,11,152,8CP,0,8D0,152,8CB,107,8B9,11,152,8CP,0,8D0,117,157,8CB,122,8AB,8B9,0,152,8CB,107,8A9,0,8D0,117,157,8CB,102,8AB,8B9,0,152,8CP,0,8D0,117,8B9,11,152,8CP,0,8D0,117,8B9,1152,8CP,0,8D0,117,8B9,1152,8CP,0,8D0,117,8B9,114,153
60300 DATA 820,117,157,8CB,122,8AB,8B9,0,152,8CB,107,8A9,0,8B5,112,8CB,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,18B,110,8B9,100,8BB,100,8BB,100,8BB,100,8BB,100,8BB,100,8B9,100,8BB,100,8BB,100,8BB,100,8BB,100,8BB,100,8BB,100,8BB,100,8B

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1 REM (97 inverse video "2") Edit this until you have lines 1 to 7, 97

```
## Body Company  
## Body Comp
```

inverse video 2 each. Enter the following Pokes as a direct command:

POKE 16510,0 POKE 16511,205 POKE 16512,2 POKE 16514,118 POKE 16515,118

To check whether the Rem-statement has the correct length, type:

PRINT PEEK 16396 + 256 * PEEK 16397

This should give 17230. Enter the following program and Run this.

10 FOR A = 16516 TO 17228

20 IF PEEK A<> 158 THEN POKE A,158 30 NEXT A

Thereafter delete this program and enter a hex-loader. Run the loader and type in all the hex-codes from listing 1. Delete the hex-loader line by line and type in the Basic program — listing 2.

Save the program auto-run by: GOTO 350

The machine-code program transforms the normal display file into the high-resolution display file.

The code of a character in the normal display file corresponds with the eight codes of a UDG — User-Definable Graphic.

When the Basic program is run you are asked to define UDGs, or not. If the answer is no

ZX-81



M Geerling and S Besmon make more of the limited graphics capability of the ZX-81.

HIGHRES

then the program will be stored above Ramtop including the character-set. If no UDGs were defined before, this set is empty. If the answer is yes the computer will ask for a character-code. Thereafter it will ask for the eight numbers to build up a UDG.

When you have completed the UDG-defining you have two options, either you can save the character-set including the complete program on tape, or — if you do not want to save on tape — it is all stored automatically above Ramtop.

When the program is stored above Ramtop, you can write your own program or load an existing one. A program should begin with:

RAND USR 25614

to put the computer in high-resolution mode. You can transform the normal display-file by: RAND USR 25686

As CHR\$ (0) is not transformed you should print a CHR\$ (1) to remove a character from the high-resolution display — the transforming routine removes CHR\$ (1) from the normal display file. Your own program should finish with:

RAND USR 25602

to put the computer back to normal resolution. The high-resolution screen is cleared by:

RAND USR 25626

The character-set starts at address 16717—this is in Ramtop: 25772. Do not use the ZX-81 Scroll, because the computer will crash.

```
100 REM. ** BASIC-HI-RES **
20 PRINT "ENTER CODES FOR UDG"
"5 ? (Y/N)"
"30 IF INKEY$="" THEN GOTO 30
35 LET A$=INKEY$
40 IF A$="N" THEN RAND USR 185
14
50 IF A$="Y" THEN GOTO 100
60 GOTO 30.
100 CL5
110 PRINT "CHARACTER-NUMBER ? (2-6)
120 INPUT CN
130 IF CN <2 OR CN > 63 THEN GOTO
120 PRINT "ENTER 8 CODES..."
150 PRINT "ENTER 8 CODES..."
160 LET X=16717+(CN *8)
170 PRINT "ENTER 8 CODES..."
160 LET X=16717+(CN *8)
170 PRINT "CN X+7
180 INPUT C
190 PRINT "HORE CHARACTERS ? (YN)"
180 INPUT C
210 PRINT "HORE CHARACTERS ? (YN)"
230 IF INKEY$=" THEN GOTO 230
240 LET A$=INKEY$
250 IF A$="Y" THEN GOTO 280
265 IF INKEY$=" THEN GOTO 280
265 IF INKEY$=" THEN GOTO 280
270 PRINT "SAUE THESE, CHARACTER
300 IF A$="N" THEN RAND USR 165
14
310 IF A$="N" THEN RAND USR 165
14
310 IF A$="N" THEN GOTO 280
320 CL5
320 CL5
320 CL5
320 FINKEY$=" THEN GOTO 340
320 CL5
320 CL5
320 CL5
320 SAUE "BASIC-HI-RES"
350 SAUE "BASIC-HI-RES"
350 RUN 20
Listing 2. The Basic program.
```

```
Listing 1. The hex codes.
                     7676210064220440
2191401100640185
02EDB0CDC3030000
007600029E02E976
76CD29083E1EED47
DD218102C9CD1964
3E08ED47DD212D64
C92100670EC00620
                                                                                                                   9202CD2002DD212D
64C3A402E92A0C40
2311006706187EFE
00280BFE01200236
16514
16522
                                                                                             16618
16626
16634
16642
                                                                           557
818
                                                                                                                                                                         812
16530
16538
16546
16554
16562
                                                                                                                                                                         565
                                                                           648
775
917
777
                                                                                                                                                                         394
                                                                                                                   00C5CD8464C1237E
FE76200C23EBC501
E90009EBC110DFC9
1318DBE5D521AC64
                                                                                             16650
                                                                                                                                                                    =
                                                                                                                                                                         988
                                                                                              16658
                                                                                                                                                                         884
                                                                                             15555
15574
                                                                                                                                                                          1110
16570
                                                                                                                                                                         1009
                                                                            581
                     369E2310FB36C923
0D20F3C921DFE611
2100F30EFE061610
FE06C0ED78D3FF19
CD556405C23C64CD
                                                                                                                                                                         817
16578
                                                                           804
992
                                                                                                                   E63F06004FCB21CB
                                                                                              16682
                                                                                                                    10CB21CB10CB21CB
1009EB06081A7713
                                                                                             16690
16698
16586
16594
                                                                           588
                                                                                                                    D511210019D110F5
D1E1C9 = 635
                                                                                             15795
15714
16602
                                                                              300
15610
```

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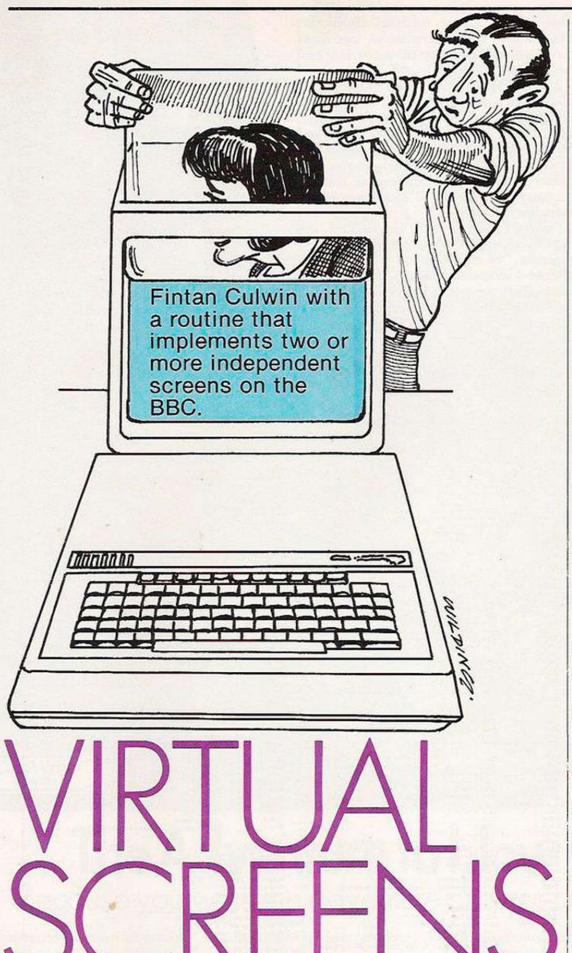
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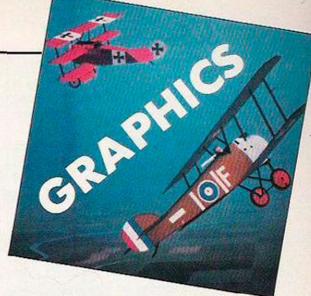
PROFISOFT GMBH, SUTTHAUSER STRAITE 50/52, 4500 OSNABRUECK, WEST GERMANY



IN THIS ARTICLE I will explain the concept of virtual screens and explain how the facility can be implemented on the BBC by a combination of in-built firmware and the machine-code utility presented. In order to do this it will be necessary to address screen memory directly. I will explain the basis of what I believe to be the best method of calculating a screen memory

Virtual screens can be configured on some other machines. The basis of the screen is to allow a multi-coloured mode to be used as two or more independent screens. Each virtual screen will have a lower number of colours, but the division does not take up any more memory. Applications for virtual screens include: having a permanent "help" screen on one virtual screen which can be accessed immediately from another virtual screen; allowing each user in a multi-user application to have an independent screen area; producing a screenful of information without the user seeing it; and revealing it instantaneously.

This last use of virtual screens is already partly catered for in the BBC's firmware. By using the VDU 19 command a logical colour can be assigned to the current background colour. Information can then be put on to the



screen in this colour, without actually being visible. A second use of the VDU 19 command will then reveal the information - see User Guide page 164. What is not present in the BBC's firmware is a straight-forward method of removing the information so presented permanently from the screen.

This system will allow a four-colour mode to be used as two two-colour virtual screens. The 16-colour mode can be configured as two fourcolour screens, four two-colour screens, or a two-colour screen combined with an eightcolour screen.

In order to explain how virtual screens can be produced it will be necessary to look at how colour information is coded in screen memory. In a four-colour mode each pixel is controlled by two bits in memory, this gives four possible combinations - 00 01 10 11; corresponding to the four permissible colours. In the 16-colour mode each pixel is controlled by four bits; giving the 16 possible combinations:

To return to the four-colour mode, if the lefthand and right-hand bits can be set and cleared independently in combination with the VDU 19 command then two independent screens can occupy the same memory space. It is possible to set the bits by using logical colours 1 and 2 respectively. Logical colour 0 is the background colour naturally and colour 3 will be displayed or set according to both bits and has to be ignored as a physical colour with virtual

An example may make this clearer: If a pixel is to be displayed in virtual screen one then the right-hand bit has to be set. If it has to be displayed in virtual screen two then the left-hand bit has to be set. If both bits are set then the pixel will be displayed in both screens one and two. Consequently, when logical colours are assigned to display a virtual screen; colour three has to be assigned to the same colour as colour one or two. Similar considerations apply to the 16-colour mode working on four rather than two bits.

For a logical colour to be removed from the screen the bits which control it have to be cleared. To clear logical colour one the righthand bit has to be cleared. This will have no effect on logical colour two controlled by the left-hand bit; but will affect logical colour three controlled by both bits. The effect will be to reset the pixel from logical colour 3 to 2, which is exactly what is required. The facility to clear just one bit in screen memory is not catered for in the firmware. The routines included here do just this. A set of procedures for controlling 16-colour mode virtual screens are given in listing 2.

(continued on next page)

(continued from previous page)

Having outlined how colour information is controlled by two or four bits, before presenting the utility, it will be necessary to show how these bits are organised in memory.

Screen memory occupies space between Himem for any mode and location 8000 hex. For a four-colour mode each byte will control four pixels. For the 16-colour mode each byte will control two pixels.

The relationship between where a byte appears on the screen and where it exists in memory is equally complex. For all modes apart from Mode 7 the first eight bytes from Himem onwards control an area of pixels on the top left-hand side of the screen. The next eight pixels control an area to the right of this. This continues until the right-hand side of the screen is met. The next byte either Himem+320 or Himem+640 and the subsequent seven bytes control an area underneath the area controlled by Himem to Himem+7.

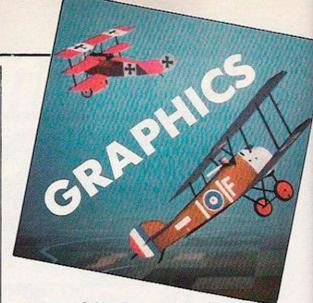
Each complete set of 320 or 640 bytes corresponds to one row of characters on the screen. If we want to calculate a memory address from the X, Y text co-ordinates, each X co-ordinate will increase the memory address by 640 or 320

from Himem. All the published algorithms which I have seen concentrate on ingenious methods of multiplying by 320 or 640, in order to obtain the address.

This is totally unnecessary as a faster method is available within the firmware. Within the operating system Rom two tables are maintained — one for multiplying by 640 used for Modes 0 to 6 and one for multiplying by 40 for Mode 7. In order to find out the increase in memory address above Himem, all that is necessary is to use the X co-ordinate as an index into this table.

Once the virtual utility is installed in memory, either by assembling it from the code presented, or by loading a previously assembled version into memory, it can be used in one of two ways. Both methods require it to be Called with the first integer parameter indicating the virtual screen to be cleared. If this is the only parameter then the whole screen will be affected.

The second method will allow only a section of the screen to be cleared. The Call must now be accompanied by five integer parameters, the first is the virtual screen as before, the next four are the X left, X right, Y high and Y low co-



ordinates defining the area to be cleared.

The X co-ordinates are based on a 80-column screen for Modes 1 and 2. A 40-column resolution is available for Mode 5. No range checking is performed on these co-ordinates; any outside the range will cause unexpected and possibly dramatic effects. If an incorrect number of parameters are passed then a "virtual error" error message will be given.

To use the assembler code an assembly address will have to be given and the screen (continued on page 119)

```
3170 STA macv
3180 JMP endcond
3190.mutbe2 LDA ***PO v mask for virtual colour 2
3200 STA mask
3210 J
3220ENDPROC
4000DEF PROC SCREEN
4010C OPT opt
4010C OPT opt
4020C nor row
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   1580 JHP main
1590)
1600ENDPROC
2000DEP FROC MAIN
20101 OP1 set
2020 .main
2020 CDA &601
2040 STA taddress
2050 LDA &602
2060 STA taddress+1
2070 LDA (taddress), Y
2080 GTA virtual \ get and store requested
colour
2100 J
2110 IF fourcol THEN PROC FOURCOL ELSE PROC SIXTEENCO
       Main program.
                   Main program.

LOGGEM VIRTUAL SCRENS HODE 1
1106EM FRI JULY 9PH ??
120FROC OPTIONS
130HODE mode
140FOR opt = 0 TO 3 STEP 2
150F2-assemble
160FROC DATA
170FROC PARAMATERS
180FROC MAIN
190FROC SCREEN
200MEXT Opt
210FROC_TEST
220 HODE ?
230 PRINTTAB(G) "VIRTUAL SCREEN"
230 PRINT "STERT ADDRESS "1"assemble
250 FRINT "STERT ADDRESS "1"ASSEMBLE
250 FRINT "STERT ADDRESS "1"PX
270 FRINT "STERT ADDRESS "1"PX
270 FRINT "STERT ADDRESS "1"PX
270 FRINT "STERT ADDRESS "1"BX
270 FRINT "STERT ADDRESS "1"PX
270 FRINT "STERT ADDRESS "1"BX
370 FRINT "STERT "STERT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                4-54-5
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  LDA address
LDA address
LDA address+1
STA taddress+1
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       4000 STA taddress*: \ take temporary copy of base address 4090.mext char JSN one char 4000. CLC 4110 LDA taddress 4120 ADC 88 4130 STA taddress 4140 LDA taddress*: 1 4150 ADC 80 STA taddress*: 1 ADC 80 STA t
                          510CLS
520PRINTTAB(8) TVIRTUAL SCREENS ****
530PRINT **HODE (1,2 or 5) *;
540REPEAT
500CPEAT
550res-GET
550res-GET
550res-GET
550res-49 OR res-50 OR res=53
570eode = res-48
5801F mode = 1 OR mode = 5 THEN fourcol=TRUE ELSE f
ourcol = FALSE
5901F mode=5 THEN threetwenty=TRUE ELSE threetwenty=
FALSE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     INC twieft
LDA twieft
CMP xright
BCC next char \ do another 8 byte block
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             ALSE
6001F fourcol THEN cois = 4 ELSE cois = 10
6101NPUT' "ASSEMBLY ADDRESS & address &
620assemble=EVAL("&"+address )
620assemble=EVAL("&"+address )
620assemble=EVAL("&"+address )
620assemble=EVAL("&"+address )
620assemble=EVAL("&"+address )
620clooper PRDC_PARAMATERS
1010C OFT opt; entry
1020
1020 CHP 600de
1030 CHP 600de
1040 BNE error \ branch if not cor
1050 LDA &600
1060 CHP 61
1070 BEQ no_paramaters
1080 \ cet up x and y de
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           LDA (taddress), Y
AND mask
STA (taddress), Y
DEY
                                                                                                                                                                     CLC
ADC address
STA address
LDA address+1
ADC temp
STA address+1 \ add 640 or 320 offset
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     BPL one pix \ do one block of 8
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            2340 LDA add
2340 ADC tem
2370 STA add
2370 STA add
to base address
2390 LDA xle
2390 CLC
2400 ROL A
2410 ROL A
2420 ROL A
2430 CLC
2440 ADC addr
2450 STA addr
2450 STA addr
2450 STA addr
2450 LDA 80
2470 ADC addr
2490 ROL A
2490 ADC addr
2510 LDA addr
2500 LDA addre
2510 LDA addre
2550 ADC bitle
2530 STA addre
2550 ADC bitle
2500 BCC next
2510 CMP yhi
2600 BCC next
2610 ACC BCC
2600DF PROC SIXTEENCOL
3010I OPT opt
3020 DCP
3030 LDA #600
3040 SEC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          STA address-1 \ add 640 or 320 offset

LDA xleft
CLC
RDL A
RDL A
RDL A
RDL A
ADC address
STA address
LDA e0
ADC address*1
STA address*1 \ add to base address
LDA address
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  CLC
RDR temp
RDR temp+1
LDA temp+1 \ changes xlo+040 to xlo+32
                                                                                                                                                                             CMP 45
BEG get paramaters
\ Obtain passed paramaters
            1110 orror iBRr

1120.error iBRr

1130)

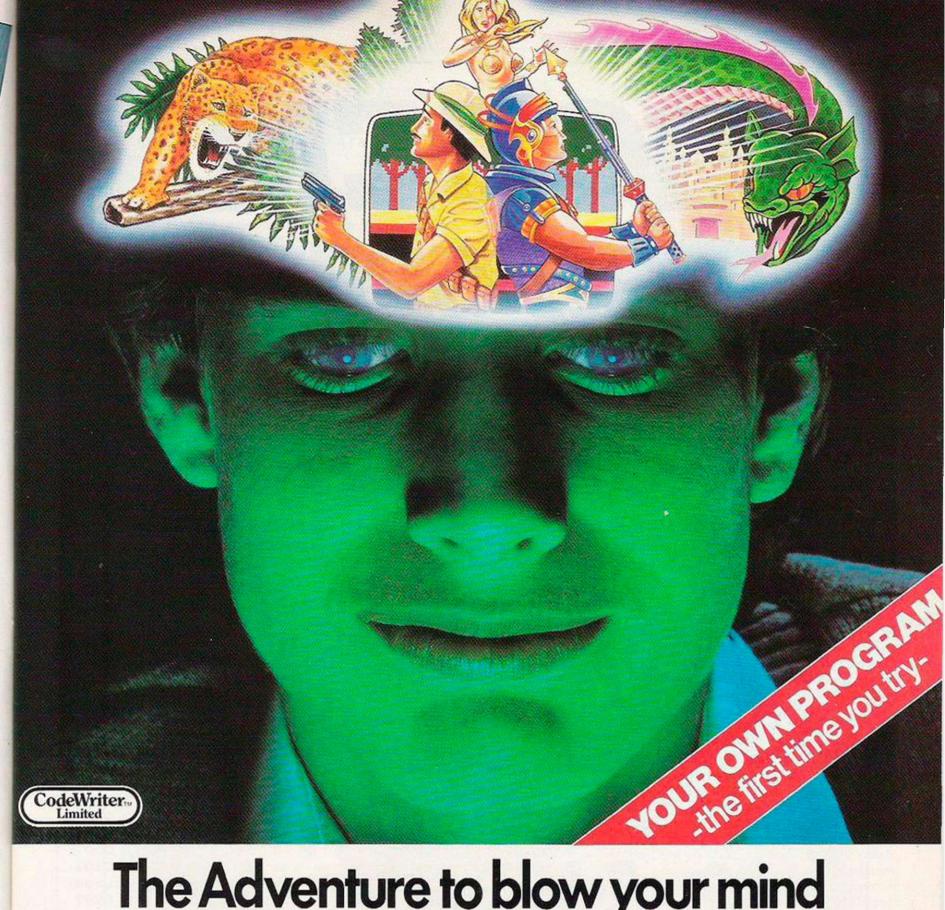
114079%=688

11506(PX+1)="virtual error"

1160PX714N0

1170PXx9PX-17
                                                                                                                                                                        REH error message

1.00_paranaters
LDA 80
STA ylo
STA ylo
STA xleft
LDA 831
STA yni
LDA 879
STA xright \ set up default paranaters
JMP main
laters
LDA 6004
STA taddress
LDA 6005
STA taddress
LDA 6005
STA taddress),Y
CLC
ROL A
STA xleft \ get and convert passed x
LDA 6007
                 1210
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          9110.80m0e : NUP : NUP 9120.Bitten : NUP 9120.Bitten : NUP : NUP 9130)
9140taddress = $70
9150table = $72
91607table = $75
9170table7!= $63 : REM adddress of *640 table 91807monde = mode 91801P threetwenty THEN ?bitten=$40:bitten?!=! ELSE ? bitten=$80:bitten?!=?
9200FEM bitten is address difference between rows: 32 0 or $40
9210ENDPRIC 10000DEF PRICE TEST 10010 IF fourcol THEN kols=2 ELSE kols=4 10020 VBUZ4.0;112;179:1030;28,0.31.19.28, 10030 IF NOT fourcol THEN VBUIF9.8,110;19.0.510; 10040 FOR thiscol = kols TO 1 STEP -1 10050 IF fourcol THEN GCOL 0,thiscol ELSE GCOL 0,2°thiscol
                                                                                                                                                                          STA xleft \ get and convert passed x
LDA 6607
STA taddress
LDA 6008
STA taddress)
LDA (6008
STA taddress)
LDA (7008
STA taddress)
LDA (7008
STA xright \ get and convert xright
LDA 6608
STA taddress
LDA 6608
STA taddress
LDA 6608
STA taddress
LDA 6008
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    TAY
DEY
LOA +680
SEC
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             10050 IF fourcal TMEN GCOL 0, thiscal ELSE GCOL 0,2°t scal
10060 PL074,512-thiscal=100,512-thiscal=100
10070 PL074,512-thiscal=100,512-thiscal=100
10090 PL074,512-thiscal=100,512-thiscal=100
10090 PL074,512-thiscal=100,512-thiscal=100
10100 PL074,512-thiscal=100,512-thiscal=100
10110 NEXT thiscal=100,512-thiscal=100
10110 NEXT thiscal=100,512-thiscal=100
10120 FOR thiscal=1 TO kols
10130 PRINT-PRESS ANY KEY TO"-TEST VCOL ";thiscal=10140 res = GET
10150 CALL entry,thiscal="">10150 CALL entry,thiscal=""
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    BPL mask_it \ value of A on entry to pr
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               CMP #1
BME muntbe2 \ 1# not 1
LDA #AGF
```



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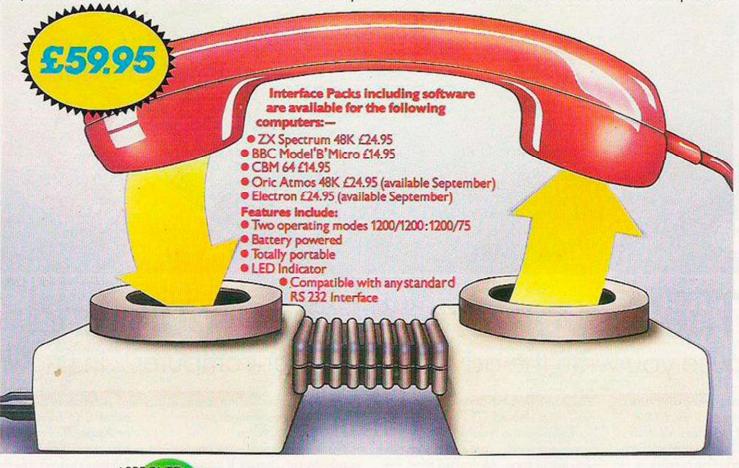
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```
TRATION OF CONFIGURING TWO
               OLOUR VIRTUAL SCREEN IN MODE 2
               AR CONSIDERATIONS WILL APPLY
              HER CONFIGURATIONS
             11 (3)
              to hold actual colours
             &D10
             'y address to machine code
            3PLAY (2,3,4,0,6)
            pare to write on screen one by displaying
            4 : PRINTTAB (5,5) "HELLO"
            B : PRINTTAB(5,7) "HELLO"
          1 12 : PRINTTAB (5,9) "HELLO"
          TAB (5,11) "THIS IS" "TAB (5) "SCREEN ONE" "TAB
          NY KEY"
          DISPLAY(1,0,1,7,2)
         Jisplay screen one, and write screen two
         R 1 : PRINTTAB(5,6) "HELLO"
         R 2 :PRINTTAB(5,8) "HELLO"
        JR 3 :PRINTTAB(5,10) "HELLO"
        TTAB (5, 12) "THIS IS" ' TAB (5) "SCREEN TWO" ' TAB (
        ANY KEY"
       ET
       JC DISPLAY (2,3,4,0,6)
       M switch screens
      GET
      ROC_DISPLAY(1,3,4,0,6)
      =GET
      ROC DISPLAY (2,0,1,7,2)
     (=GET
     a%=3:CALL virtual,a%
     a%=4: CALL virtual, a%
     REM screen two displayed : clear screen one
     COLOUR 4 : PRINTTAB (3,5) "SCREEN ONE " ' TAB (1) "HAS
   VIRTUALLY"''TAB(3)"CLEARED !!"
   PROC_DISPLAY(1,6,0,4,3)
   I REM write and display screen one
   0 a%=1 : CALL virtual, a%
  O a%=2 : CALL virtual, a%
  20 COLOUR 2 :PRINT TAB(3,6) "SO HAS "' TAB(3) "SCREEN
  0 "''TAB(3) "SOODBYE !!"
 21 REM clear and write screen two
 430 PROC DISPLAY(2,0,1,7,2)
 799 STOP
 000 DEF PROC_DISPLAY(screen%,col0,col1,col2,col3)
.010 REM paramaters are screen to be written and four
actual colour numbers
1020 actual (0) =col0: actual (1) =col1
1030 actual (2)=col2: actual (3)=col3
1040 REM store actual colour numbers
1050 screen% = screen% MOD 2
1060 REM set screen% to 0 or 1
1070 IF screen% = 0 THEN mask%=3 ELSE mask%=12
1080REM set mask as necessarry
1090 FOR logical%=0 TO 15
1100REM consider each logical colour
1110 REM consider each logical colour in turn
1120 masked_out = logical% AND mask%
1130 REM mask out bits
1140 IF screen%=1 THEN masked_out = masked_out DIV 4
1150 REM reduce to lo bits if hi bits
1160 REM value now in range 0-3 ( 2 bits)
1170 VDU19, logical%, actual (masked_out); 0;
 ~ NEXT logical%
           inn appropriate actual colours according t
```



mode selected. After the code has assembled, a test routine will be initiat information given to allow the code to be As conditional assembly is involved the length of the code cannot be given assemble in its longest version into two pages of memory (/K). A different of the code will have to be assemble screen mode.

The notes that follow should help stand what each section is doing.

The first procedure met is P which selects the mode to be cor the assembly address. Various flag according to the mode chosen.

Within the actual assembly loop used to set up a data block. Mo used within the program. The k "table" is a page zero address point to the *640 table at address location labelled "mowde" co the code is assembled for, and 320 or 640 depending on the

The parameters are proce assembled by Proc-Paramet the entry point to the code ' commences by testing the machine and branching to this is incorrect. The nu passed is then tested anused if this is inappropri: page 214 for an explana meters are picked up. T either picked up from the page 6 or set to the defa This section exits to " of a basic error messa routine, is explained 440.

Main commences screen colour to be according to four or screen address is formula Himem Xleft*8. Each rov row", the base s and a check mad processed. The routine.

Proc-Screen
actually contro
led "one-row"
A copy of the
taken. One cl
xleft and the
return is ma
have been d
byte block
mask previ

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A SERIOUS LIMITATION of the Dragon is that the screen is only 32 characters wide. Various attempts have been made to remedy this, the best of which gave a mere 51 characters. The following program gives more than double this, in fact an astonishing 128 characters.

This amazing width is accomplished by displaying a section - the size of the normal text screen - at a time.

For the sake of speed and simplicity to the user I have written the entire program in machine code which can be accessed with the use of new Basic commands. The program introduces 23 new instructions altogether, from a sound-enveloping command to one that manipulates the video chip.

To enter the program first type the hexloader - listing 1 - and Run it. Enter the first line of hex values from the machine-code dump, pressing Enter after each one. The loader will then ask for the line total which is the decimal number after = sign. Type it in and press Enter. If you have typed in the values correctly, the screen will clear and you can carry on, if not, you will have to re-enter the line.

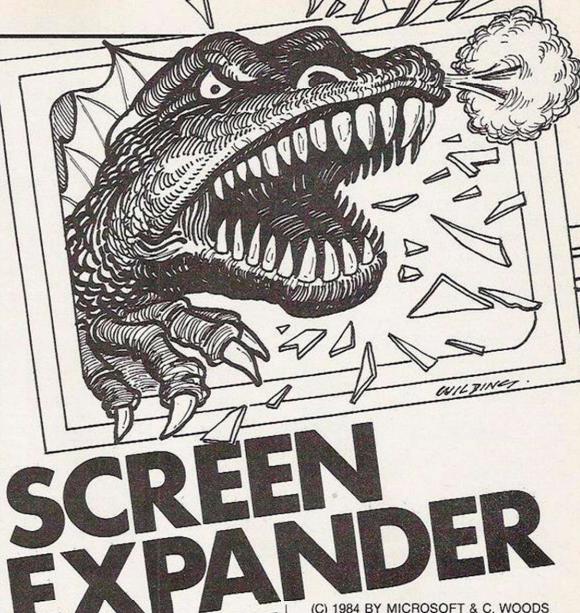
When you have entered all the lines the program will end. Then save the code with: CSAVEM "BASIC + ", 31522, 32768, 31522

I suggest that you save it twice just in case there is a recording error. Then switch the computer off then on and type in CLEAR 200,23329

Rewind the tape and type CLOADM "BASIC+"

Once it has loaded, type Exec. The following message should then appear:

(C) 1982 DRAGON DATA LTD 17K BASIC INTERPRETER



Listing 2.

Chris Woods 20 X=48: Y=24 gives Dragons a 128- 40 x=x+(R=1 AND X>0)-(R=2 AND X<96) character screen, plus 28 60 MOVE X,Y:DISP extra commands. 70 PRINT@272, "x";:COPY

The commands in action. 10 CLR 32

Listing 1. The hex loader. 10 CLEAR 200,31521

20 FOR A=31522 TO 32754 STEP 14

30 CLS

40 Z=160

50 CS=0:PRINT@0, "LINE VALUE ="; A;

60 FOR B=A TO A+13

";:PRINT@74,"";:INPUT H\$:H=VAL("&H"+H\$ 70 PRINT@64, "HEX VALUE): IF LEN(H\$) <>2 THEN PLAY"L5AGA": GOTO 70

80 PRINT@(B-A) *2*Z, H\$: POKE B, H: CS=CS+H: PRINT@32, "LINE TOTAL ="; CS; 90 NEXT B

100 PRINT@96, "CHECKSUM";: INPUT LT: IF LT<>CS THEN PRINT@448, "INCORRE CT LINE.PRESS ANY KEY TO TRY AGAIN.";: Z=Z+32 ELSE 120 110 IF INKEY\$="" THEN 110 ELSE PRINT@448,"

120 NEXT A

Listing 3. Demonstration of the envelope command.

";:GOTO 50

10 CLS

20 INPUT"L,F";L,F

30 PRINT"PRESS ANY KEY TO CHANGE L AND F"

40 ENV L,F,RND(63),RND(63),RND(63),RND(63),RND(63),RND(63),RND(63), RND (63) ,RND (63) ,RND (63) ,RND (63) ,RND (63) 50 IF INKEY\$="" THEN 40 ELSE 10

The hex dump.

31522 ---- 8E 7B 49 BF Ø1 7A 86 7E B7 Ø1 79 8E 1736 31536 ---- BF Ø1 68 8E 7E 26 BF Ø1 6B BD BA 77 8E 7F 1664 = 179531550 ---- A8 BD 90 E5 8E 00 00 BF 7F FE 39 81 80 25 31564 ---- Ø1 39 B7 7F FB BE ØØ A6 1Ø 8E 7F 1D B6 7F = 1598 31578 ---- FB A1 A4 26 20 CE 00 00 A6 21 4A E6 86 33 = 1540 31592 ---- C5 81 00 26 F7 11 A3 22 26 ØD E6 21 5A 3A = 128731606 ---- BF 00 A6 AD BB 04 86 A9 39 31 26 A6 A4 81 = 1624 31620 ---- 2A 26 D1 B6 7F FB 39 BD 00 9F BD 8E 83 1F = 1747(hex dump continued on next page)

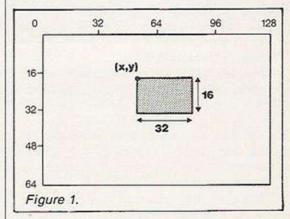
If it does not then there is a mistake in the machine code. The program is now initialised and the extra Basic commands available.

If you do not want the large screen, type CLEAR 200,31521

instead which uses less memory.

Now to the commands. The maximum values for the parameters are in brackets - the minimum values are always zero.

Move X, Y (96, 48): This command specifies which part of the screen is to be displayed. In figure 1, the shaded area is the section which will be displayed. The X and Y coordinates refer to the top left-hand corner of the shaded



Disp: After the coordinates have been specified, Disp displays the chosen area.

Copy: This is the opposite of Disp. It copies the text screen into the previously chosen area. Clr N (255): This fills the whole - 128 by 64

screen with characters of code N.

Up, Down, Left, Right: These four commands scroll the screen in the appropriate (continued on next page)

(continued from previous page)

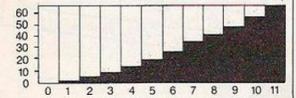
directions. In fact they change the X or Y coordinates — as in Move — by +1 or -1 and then activate a Disp command.

Epson: This dumps the whole screen out to an Epson RX or FX printer. All graphics symbols are printed out as a G. Yes it will print 128 characters on an 80-character Epson.

Listing 2 shows some of these commands in action.

Env L,F, A1, A2 ... A14 (255, 255, 63, 63..., 63): This command allows you to define the waveform, frequency and length of a sound. L and F specify the Length and Frequency of the sound respectively. A1 to A12 specify the amplitude — volume — of the sound at each of the 12 stages in each cycle.

Example: Env 20,50, 1,2,5,8,13,18,25,32,39, 47,55,63, would product the following cycle:



and hence a waveform like this.



Listing 3 demonstrates this command.

Noise L (65535): This command produces

white noise of length L.

Repon T1, T2 (255, 255): An auto-repeat facility can be very useful, Repon gives this. The command causes the keyboard to repeat T1/50 seconds after the key was pressed and then after every T2/50 seconds.

Repoff: This cancells Repon.

Beepon L: This command causes the Dragon to emit a note of length L each key-press.

Beepoff: This cancels Beepon.

Fast: This command puts the Dragon in fast mode — obviously this will cause problems on some Dragons.

Slow: This puts the Dragon into slow mode. Pause N (65535): This causes the Dragon to wait for N 50ths of a second.

Slpron N (65535): This slows down the Dragon printing routine. The larger N is, the slower the printing.

Slproff: This cancels Slpron.

Vdgst N (65024): This extremely useful command instructs the VDG chip where the graphics memory should start. For example:

10 VDGST 0: GOTO 10

This program displays memory locations 0-511 on the text screen in real time — it is quite interesting. Due to limitations of the hardware N must be a multiple of 512 (0, 512, 1024 . . .).

When using this command with graphics it should be after Screen command.

Trans F,T,L, (65535, 65535, 65535): This command moves a block of memory from F to T of length L.

Doke A,B (65535, 65535): This is a double Poke i.e., it is the same as:

POKE A,INT (B/256): POKE A + 1,B - 256 × INT (B/256)

Note that you may use any variables, expressions or numbers with these commands.

(hex dump con																
31634				FE 1A							1F 1A		F7 8E			2023 1488
31662	COMPANIE .							4A						10	_	1574
31676													1F	10	=	1336
31690		District to				A VENEZUE IN	22 1000	98	Anni Anni	laborate.	10000	100 P. C.	Charles Service	8C	=	1343
31704	12000					A CONTRACTOR OF THE PARTY OF TH							SE 5A		=	1338
31718				60						THE PARTY OF			FF		_	2060
31746	1025010								AB			300	FE		=	2083
31760								7B				0.00	FF	CONTRACTOR OF THE PARTY OF THE	=	700000000000000000000000000000000000000
31774	1000			ØF		3300	(20.0501)	THE SEC.				7F	On the same	C1		1458
31788			アキアフィーン	ØF BD				BD				7F 4Ø	The state of	39 BD	=	1248
31816													NATIONAL PROPERTY.	34	=	1518
31830				6D										ØD	=	1380
31844	005409450			80	13V2V200	NAME OF TAXABLE PARTY.	The same of the sa	464700	50000000000000000000000000000000000000	CHECK TO THE	125 9 SOL				=	
31858				86				1A				1A	SE SA	4Ø 83	=	1140
31886		Cherry										ASSESSED			=	
31900								27					10		=	1596
31914	ALCOHOLD .							1F				7F	TRUMPING I	39		1751
31928				13			9F 26	14607-00	SE SE	7F	14	39	90 BD	10	=	1978
31956						Dut Park		10				77.850	3F	100000	_	1221
31970						Plware	A CASSAGE	ALC: NO.	50 5000	Chicagonia		Total Control	FD		=	1499
31984	Carlotte .	20		10				EC	Secretary of the	100000000000000000000000000000000000000	10000	100000000000000000000000000000000000000	B4	Variety		1542
31998				BD 1F			10	SE ID	7D 26				BD		=	1589
32026								80					34		_	1451
32040							10	81	The section of the	ANDREAM			58		=	1110
32054			7D	C4	10	27		78	86	7D		10		ØE	=	1415
32068		Sanger.		62	Committee of					26		3D		7D	=	1550
32082									C4			3D 44	1F 56		=	1849 1532
32110				8E			1F		B3			2B	Charles of the	31	=	1152
32124	Other Charles (C)	20	F7	10	80	00	00		02		21	10	Con in	7D		922
32138	CHECK THE REAL PROPERTY.							145000				BE	00000	C3		2102
32152			00 EA			CØ		10000000	48 7D				B7 31		=	1375 1592
32180																1607
32194	39	00	ØA	28	00	00	00	00	00	88	00	00	00	00	=	107
32208																1880
32222																1308
32250																1423
32264	00	9F	BD	8E	83	80	00	00	.10	27	ØD	79	BF	7E		1267
32278																1369
32292															-	1761 1650
32320																1936
32334	00	BA	CØ	81	FF	26	09	7F	7E	EB	7F	7E	EC	7E		1864
32348																1719
32362																2167 1263
32390																1598
32404	7F	7E	ED	7E	9D	3D	CC	FF	FF	FD	01	51	FD	01		2137
32418																1569 1318
32432																1415
32460	ØC	BF	F7	7E	78	BD	7F	14	8E	7E	47	BF	01	ØD	=	1576
32474	7F	7E	ED	7F	7E	EB	7F	7E	EC	39	8E	9D	3D	BF		2075
32488																1714
32502 32516																1756
32530																999
32544	30	7B	AB	43	04	01	3B	7B	EØ	43	03	00	E1	7B		1235
32558 32572																1157
32586																1056
32600	D9	4D	04	01	37	7B	88	44	04	01	23	7E	EE	4E	=	1166
32614																987
32628 32642																1275 1219
32656																892
32670	84	7E	AF	52	06	01	C2	7E	E4	2A	20	28	43	29	=	1292
32684	20	31	39	38	32	20	44	52	41	47	4F	4E	20	44		819
32698 32712																1025
32726																708
32740	4D	49	43	52	4F	53	4F	46	54	20	26	20	43	2E	=	909 _
32754	57	4F	4F	44	53	ØD	ØD	80	00	48	00	99	00	00	=	489



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The Spectrum Connection

```
POKE53280.0:POKE53281.0
                                                                   BY P. EDMOND"
10 PRINT"IN BILL DA SHOWARN
     PRINT"
     PRINT"N MOVE THE TWO SMALL CARTS WITH THE"
20
     PRINT" FOLLOWING KEYS :-"
                                                                        RIGHT TROLLEY"
25
     PRINT'S LEFT TROLLEY
                                                                                   Min
30
                                                         LEFT
35 PRINT"N C=
                                                                                   Man.
                                                         RIGHT
45 PRINT"N COLLECT THE SNOWFLAKES. ESPECIALLY THE"
30 PRINT"N LARGER ONES, TO BUILD YOUR SHOWMAN"
SS PRINT"N BEFORE THE TIME RUNS OUT ."
60 PRINT"0 IF YOU COMPLETE THE SHOWMAN YOU BEGIN"
65 PRINT"0 HGRIN . BUT WITH A SMALLER TIME LIMIT !"
                                      PRESS A KEY TO CONTINUE" : POKE198.0
       PRINT"D
 70
      GETH#: IFH#=""THEN75
      PRINT"D PARCELS COUNT AS BONUS POINTS."
 75
 SS PRINT'N PRESS 'CTRL' AND '* TO CANCEL A GAME."
 90 PRINT"D WHEN A GAME HAS FINISHED PRESS 'RETURN"
 95 PRINT"N TO RE-START."
  100 PRINT" MOUND PRESS ANY KEY TO BEGIN" : POKE198.0
  105 GETA$: IFA = ""THEN 105
  200 PRINT" MPLEASE WAIT, ENTERING DATA": I=16384
                                                            1116 DATA12.D0.AD.11.D0.29.7F.SD
1118 DATA11.D0.AD.19.D0.09.81.8D
   201 READA$: IFA$="*"THENSYS17024
                                                                   DATA19, D0, 68, A8, 68, AB, 68, 40
DATAF0, 07, A8, 29, 10, F0, 03, E6
DATAFB, 60, 98, 29, 20, F0, 03, E6
    202 L=RSC(LEFT$(R$,1))-48
203 IFL>9THENL=L-7
                                                             1120
    204 R=ASC(RIGHT#(A#.1))-48
                                                                    DATAPE, 60, E6, FC, 60, EA, EA, EA
           TERMOTHENR=R-7
                                                                    DATAA5.F7.F0.75.CE.06.D0.AD
    206 POKEI.L*16+R:I=I+1:GUTO201
    1000 DATHER ER ER ER ER ER ER ER
1002 DATHER ER R9 3F 8D 11 D0 A9
                                                                    DATA06, D0, C9, FF, D0, 08, AD, 10
                                                             1128
                                                                    DATADO,49,08.8D,10,D0.CE.08
                                                             1130
                                                             1132
    1004 DATR01.SD,21.D0,AD,12.D0,18
1006 DATAC9,AF,90,FS,A9.1F.SD,11
1008 DATAD0,AS,FF,18,65,F2,AA,18
                                                                     DATADO.AD.08.DO.09.FF.D0.08
                                                             1136 DATAAD, 10.D0, 49.10.SD, 10.D0
1138 DATAAD, 18.D4, D0, 38, A9.04, 85
1140 DATAE4.AD, 10.D0, 29.08.F0.08
1142 DATAED, 06.D0, 18.C9.38.B0.27
     1010 DATAC9,10,00,02,A2,00,86,FF
     1012 DATAE0.00.F0.03.40.C7.40.A9
1014 DATA08.8D.4E.40.A9.06.8D.4F
                                                                     DATARD.06.10.48.48.48.18.69
DATARO.85.F3.90.02.56.F4.8D
     1016 DATA40.8D,52,40,89,30,8D,51
1018 DATA40.80,00,82,27,8D,00,04
                                                              1144
                                                              1146
                                                                      DATA10.D0.29.08.F0.08.A5.F3
DATA18.69.20.85.F3.90.02.E6
     1020 DRTA9D.28.04.CA.10.F7.C8.C0
1022 DRTA9D.28.04.CA.10.F7.C8.C0
1022 DRTA0E.F0.1F.AD.4E.40.38.E9
1024 DRTA28.8D.4E.40.B0.03.CE.4F
1026 DRTA40.AD.51.40.38.E9.28.8D
1028 DRTA51.40.B0.03.CE.52.40.4C
                                                              1148
                                                                      DATAF4, A0, 00, A9, 20, 91, F3, AD
                                                                      DATA10.D0.29.08.F0.08.AD.06
DATAD0.29.80.F0.04.A9.FF.85
                                                                      DATHE7, 40, 60, 49, EH, EH, EH, EH
     1030 DHTH91,40,80,00,00,00,40,40,1030 DHTH91,40,80,00,00,10,18,D4,29,1032 DHTH0F,9D,00,04,CR,10,F5,C6,1034 DHTHFD,10,17,89,03,85,FD,8D,1036 DHTH1B,D4,29,1F,18,C9,10,90,10,00,00,00,00,00,00
                                                                      DATA78.89,40,80,15,03,89,00
                                                              1169
                                                                      DATASD, 14.03, A9.81,8D, 1A, DO
DATAA9.00.8D,0E,DC,8D,0E,DD
                                                               1162
                                                                      DATAR9,18,8D.18,D0,A9,D8,8D
DATA16,D0,A9,00,8D,21,D0,8D
              DATA03,18,69,06,88,89,10,9D
      1038
      1040 DATH01,04.A2,03,DE.81,07.BD
                                                                      DATA20, B0, A9, 00, 85, A8, A9, 28
              DATAS1, 07, C9, 12, D0, 16, A9, 10
DATASD, S1, 07, CA, 10, EE, A2, 03
DATASS, S1, 90, S1, 07, CA, 10, FA
DATASS, FF, 85, F9, 4C, D1, 40, A2
DATASS, A0, FF, 88, D0, FD, CA, D0
                                                                       DATA85.A9.A0.00.A9.00.91.A8
       1942
                                                                      DATA88, D0, FB, E6, A9, A5, A9, C9
       1044
                                                               1174
                                                                      DATA40, D0.F1.A2.00.8A,9D.00
DATA04.9D.00.05.9D.00.06.9D
DATA00.07.CA.D0.F1.AD.11.D0
       1046
       1948
       1050
               DATAFA, A5, FF, 4A, 09, 10, 8D, 11
                                                               1180
                                                                       DATA29.7F.8D.11.D0.A9.A7.8D
DATA12.D0.AD.19.D0.09.81.8D
       1054 DATABD.83.20.8D.0E.20.89.0F
1056 DATABD.83.20.8D.0E.20.89.0F
1058 DATASS.E5.FF.AA.BD.88.20.8D
                                                               1182
                                                               1184
                                                                       DATR19, D0, R9, 01, 85, F2, R9, 01
                                                                       рятая2,00,9р,00,р8,9р,00,р9
рятаяр,00,ра,са,р0,ह4,89,8F
                                                               1186
                                                                1188
               DATA13,20,89,00,8D,8E,02,20
       1062 DATA00,42,AD,8D,02,29,02,F0
1064 DATA0D,AD,02,D0,C9,16,F0,06
1066 DATA38,E9,02,8D,02,D0,AD,8D
1068 DATA02,29,01,F0,0D,AD,02,D0
        1060
                                                                        DATASD.18.D4.A9.F5.SD.13.D4
DATASD.14.D4.SD.0E.D4.SD.0F
                                                                1194
                                                                        DATAD4.89.81.8D.12.04.89.1F
                                                                1196
                                                                        DATASD, 15, D0, A9, 00, A2, 3F, 9D
       1068 DATA02, 29,01, F0,00, AD, AD, 02, D0
1070 DATAC9,90, F0,06,18,69,02,8D
1072 DATA02, D0, A5, C5, C9, 27, D0, 12
1074 DATABD, 00, D0, C9, CE, F0,08,38
1076 DATAE9,02,8D,00, D0,80,03, CE
1078 DATA10, D0, A5, C5, C9, 24, D0, 12
1080 DATABD, 00, D0, C9, 40, F0,08,18
1082 DATA69,02,8D,00, D0,90,03,EE
                                                                1198
                                                                       DATAGO.08.CA.10.FA.A9.20.8D
DATAFA.07.A9.26.8D.FC.07.A9
DATAF27.8D.FB.07.A9.00.85.F7
                                                                1200
                                                                 1292
                                                                 1294
                                                                        DATAEA,EA,EA,A9,92,80,01,00
```

1206

1298

1219

1212

1214

1218

1230

1234

1236

1238

DATASD,03,D0,SD.05,D0,A9,19

DATASD, 10, D0, A9, 02, SD, 00, D0
DATASD, 10, D0, A9, 02, SD, 00, D0
DATAA9, 22, SD, 02, D0, A9, E0, SD
DATAO4, D0, A9, 0F, SD, 10, D0, A9
DATASO, SD, 91, 02, A9, 0A, SD, 26

DATADO,89,01,80,25,00,89,08

DATASD, 29, D0, A9, 05, SD, 27, D0
DATASD, 28, D0, A9, 07, SD, 28, D0
DATASD, 2A, D0, A9, 45, 8D, 07, D0
DATASD, 09, D0, A9, 58, SD, 08, D0

DATAR9,70,8D,06,D0,A2,27,BD DATAR0,47,9D,70,07,A9,06,9D DATAR0,DB,CA,10,F2,A2,00,BD

DATA00,44,9D,40,08,BD,00,45

DATA9D, 40, 09, BD, C0, 45, 9D, 00

DATA20.BD.C0.46.9D.00.21.CA DATAD0.E5.A2.07.A9.00.95.FS

1242 DHTACA, 10, FE, A9, 18, SD, 18, D0

BILL DA

Patrick Edmond presents a gentle seasonal game for your CBM-64.

BILL DA SNOWMAN is a machine-code game for Christmas. It includes smooth scrolling - of the falling snow - and some Christmas music, though you will probably be fed up of hearing "Good King Wenceslas" and "While Shepherds Watched" after playing this game several times.

The aim of the game is to build a snowman before the timer counts from 1200 to zero. This is achieved by moving two small carts left and right to catch the falling snow and increase the snow counter. The best tactic is to catch the large snowflakes as these count for more points.

Santa Claus often visits, gliding across the sky in his sleigh pulled by his Reindeer. He might drop a few parcels which add 10 points each to your score but they do not help build the snowman, so if you are short of time concentrate on the snowflakes.

The right trolley is controlled by the following keys: M right; N left, and the left trolley these: Shift Key right; Commodore key left.

To cancel a game hold down the Ctrl key and press *. When a game has finished press Return to begin again. Note that joysticks cannot be used with this game. The snowman can be completed by increasing the snow counter to at least 21000, then the time remaining is multiplied by 10 and added to your score, then you begin building another snowman with a reduced time limit.

You can type Bill da Snowman exactly as shown and Save it, but there will be a long delay whenever you Run the program since the subroutine at line 200 takes a long time to Poke the data into memory. If you own an assembler this can be avoided as follows:

Type in lines 5 to 105 and add the following lines:

2 A = A + 1:IFA = 1 THEN LOAD"",1,1 110 SYS 17024

then Save this Basic "preload" program.

Next, with your assembler, enter the hex data of lines 1000 onwards into memory beginning at address \$4000 (hex) and save memory from \$4000 to \$4A10 on cassette after the above "pre-load" program. You can then play the game by rewinding the tape and typing Shift and Run/Stop.

1244 DRTRER, ER, ER, ER, ER, 58, 40, 28 DATR47, ER, ER, ER, ER, AD, SD, 02 DHTH47.EH, EH, EH, EH, HD, SD, 02 DHTH29.04.F0,09, H5,C5,C9,31 DHTHD0.03.4C,E5,47.4C,B8,49 DHTHH9.13.H2.04.9D,19.47.CH DHTH10.FH,4C,80.42.00.00.EH DHTH0F.FF.C0.3F,FF.F0.05.55 DHTH40.05.55.40.06.56.40.06 1250 1254 1256 1258 DATA56,40,05,65,40,05,65,40 1260 DATA05,55,40,06,56,40,05,A9 1262 DATA40,15,55,50,55,55,54,55 DATA55,54,55,65,54,55,55,54 DATA65,55,64,65,65,64,65, 1270 DRTR64,65,55,64,55,55,54,00 DATAGO,00,00,00,00,00,00,00 1274 DATA00.00.00.00.00.00.00.00.00

1084 DATA10.D0.AD.00.D0.29.06.48 1086 DATA18.69.22.8D.F8.07.AD.02 1088 DATAD0.29.06.4A.18.69.22.8D 1090 DATAF9.07.AS.FF.C9.00.F0.03

1092

1094

1096

1098

1100

1110

1112

DATA4C.B5.41.AD.02.D0.4A.4A

DATRAH, RA, BD, 2E, 06, 20, E8, 41 DATABD, 2F, 06, 20, E8, 41, A9, 00 DATABD, 2E, 06, 9D, 2F, 06, AD, 00

DATADO.4A.4A.4A.AA.AD.10.D0

DATA29.01,F0.05,SA.18.69,20

DATAAA,BD,2E,06,20.E8,41,BD

DATA2E,06,9D,2F,06,82,87,89

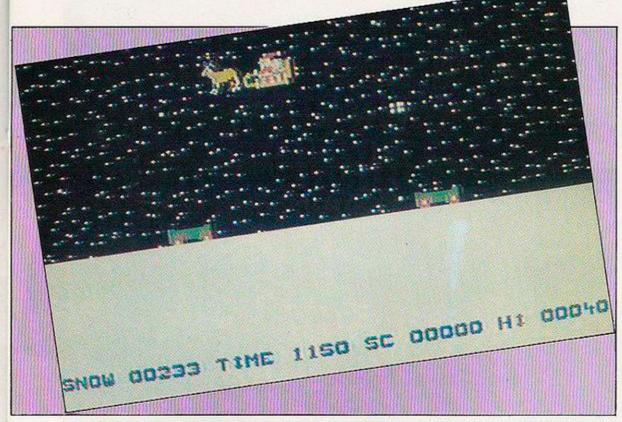
DATR40.8D,15,03,89,08,8D,14

DATA03,85,FF.48,C9.07.D0.07

1106 DATA2F,06,20,E8,41,A9,00,9D

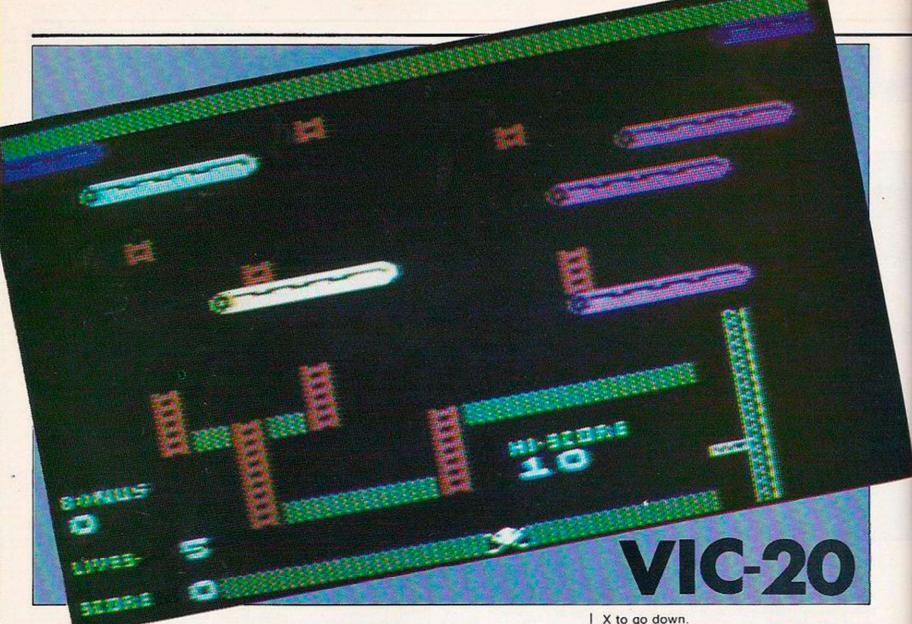
1114 DHTRA2.86,89,00,80,14,03.8E

ASNOWMAN



```
DATHOG.00,00,00,00,00,00,00
                                                  DATA00,00,00,18,00,00,00,00
      DATA00.00.00.00.00.00.00.00.00
                                                  DATROG.00.00.00.00.00.00.00.00
      DATA00,00,00,00,A0,00,0A,AA
                                                  DATA00,00,60,00,00,00,00,00
      DATABA, BA, BA, BA, BA, BE, BA, BE
                                                  DATA00.00.00.00.00.00.30.00
     DATAFF, 88, FF, FF, 88, FF, FF, 88
DATAFF, F7, 00, F7, 37, 00, 37, 00
                                                 DATA60,00,00,00,00,00,00,00
1286
                                             382
                                                 DATAGO,30,00,00,00,00,00,00
      DATERO, RO, RO, RO, RO, RO, RO, RO, RO
                                                 DATA00.00.00.00.00.60.00.00
     DATAGO, 80, 80, 80, 80, 90, 90, 90
                                            1386
                                                 DATAGO, CO. 00, 00, 00, 00, 00, 00
      THITBOO, OO, OO, OO, OO, OO, OO, OO
                                                 DATA00,00,00,03,00,00,10,00
     DATA00,00.00,00,00.00,00,00
                                                 DATA00,00,00,00,00,00,00,00
     DATAGO, 00, 00, 00, A0, 00, 0A, AA
                                                 DATA18.00.00.00.00.00.00.00.00
     DATABA, AH, AH, AH, AH, BE, AH, BE
                                                 DATA00.00.00.00.00.00.00.00.00
     DATAFF.AB.FF.FF.AB.FF.FF.AB
                                                 DATHUM, 00.00.60.00.00.00.00.00
     DRIBER, DE. 00, DE. 15, 00, 15, 00
                                                  DATA00,00,00,00,18,00,00,00
     DATHOO, 00,00,00,00,00,00,00
                                                  DATA08.00.07.07.00.00.00.00.00
                                            1400
     DATAGO, 00.00.00.00.00.00.00.00
                                                  DATA03,03,03,06,06,10,18,18
     DATA00.00.00.00.00.00.00.00
                                                  DATA30,70,30,18,18,00,06,06
1308
     DATAGO, 00.00.00.00.00.00.00.00
                                                 DATA00,70,FE,C6,C6,C6,FE,70
                                           1496
     DATA00,00,00,00,00,00,00,0A,AA
                                            1408
                                                 DATA00, 18, 38, 18, 18, 18, 18, 30
     DRIAGE, AA, AA, AA, AA, BE, AA, BE
DATAFE, AA, FE, DE, AA, DE, DE, AA
DATADE, FE, BB, FE, SE, AB, SE, AB
                                           1410
                                                 DATA00,70,FE,06,0E,30,FE,70
                                           1412
                                                 DATA00,7C,FE,96,1E,06,FE
                                           1414
                                                 DATA00.60.60.60.7E.00.00.00
     DATA90.00.00.00.00.00.00.00.00
                                                 DATA00.70.FE.C0.FC.06.FE.70
DATA00.70.FE.C0.FC.06.FE.70
1329
                                           1416
     DATAGO.00.00.00.00.00.00.00.00
                                           1418
                                                 DATA00,7C,FE,0C,0C,18,18,18
DATA00,7C,FE,C6,FE,C6,FE,7C
DATA00,7C,FE,C6,FE,06,FE,7C
DATA00,C6,C6,C6,FE,C6,C6,C6
     DATAGO, 00.90, 00.00, 00.00.00
                                           1420
     DATROG.00.00.00.00.00.00.00
132€
                                           1422
1328 DATA00.00,00,00,A0,00,4A
                                           1424
     DATABA, BA, BA, BA, BA, BE, BA, BE
                                                  DATA00, 18, 30, 18, 18, 18, 30, 18
     DATAFF, 88, FF, F7, 88, F7, F7, 98
     DRTAF7.FF.00.FF.3F.00.3F.00
                                                  DATAEF, EF, 00, EF, EF, 00, 00, 00
1336
     DATAGO.00.00.00.00.00.22.00
                                                  DATA00.C6.EE,FE,D6,C6,C6
     DHTH00,14,00,00,26,00,00,19
                                           1436
                                                 DATAGO, FC, FE, CO, FO, CO, FE
     DHTA00.00.38.00.00,60.00.00
340
     DATAFE, 0F, 80, FF, FF, C0, 1F, FF
DATAFE, 0F, FF, E0, 07, FF, E0, 07
DATAFF, 71, 07, FC, 73, 05, 81, 83
                                                 DATA00,70,FE,C0,70,06,FE,70
                                           1438
1342
                                           1440
                                                 DATA00, C6, E6, F6, D6, DE, CE, C6
1344
                                           1440
                                                 DATA00,70,FE,C6,C6,C6,FE,70
                                                 DATAGO.CS.CS.DS.DS.FE.FE.7C
                                           1444
     DATA05,81,83.05,01,63,08.02
1348
                                                 DATA90.70.FE.C0.C0.C0.FE.70
                                           1446
     DATA43,18,04,C1,06,01,80,00
                                                 DATA00, 23, 24, 25, 26, 00, 13, 13
     DATA00,00,00,00,00,00,00,00
                                           1448
                                                 DATA13, 13, 13, 00, 1F, 1E, 21, 22
     DATA00.00.0F.D0.00.3F.D0.00
                                                 DATRO0, 14, 15, 13, 13, 00, 23, 2
     DATAFF.00,00,54.00,00,A6.60
                                                 DATA00, 13, 13, 13, 13, 13, 00, 1D
358
     DATA00,96.6E,00,55.5E.00.7E
     DATAGE,04,FE,GE,87,FE,BA,A7
DATAFE,BA,41,57,FE,03,FE,BA
                                                  DRTRIE, 00, 13, 13, 13, 13, 13, 00
1369
1362
                                                 DRIBEE, 76.07. RD, 76.07.09, 1D
              77,76,0F,BB,BA,A7
1364
     DATABAZ
     DRIETS, 88, 88, 88, 88, 88, 88, 80, 80
1366
                                           1462
                                                 DATADO, EE, A9, 13, 90, 76, 07, CA
     DATA00,00,00,00,00,00,00,00
                                                 DATA40.30,47,82,02,85,FB,F0
                                           1464
                                                 DATA15.06.FB.FE.76.07.BD.76
     DATA00,00,00,00,00.00,00,06,00
                                           1466
```

```
DATA07.09.10.00.EE.89.1
      DATA76, 07, CA, 4C, 4B, 47, AD, 76
      DETER7
      DATA60.77.07.38.69.13.85
DATA0A.18.65.64.85.64.89
      DRT838.E5.F8.88.80.02.ED.40
      DATA08.90.00.08.E8.E0.40.D0
     DATAF5.A2.03.A5.FE.F0.15
DATAFE.FE.89.07.BD.89.07
1484
1486
     DATAID.D0.EE.A9.13.90.89.07
DATACA.40.99.47.A5.F7.D0.28
1488
1499
      DATAA5, F9, D0, 27, EA, EA, EB, A5
      DATAF8.D0.24.AD.1B.D4.18.C9
      DATA01, B0, 13, A9, 58, 80, 08, 00
      DATAA9,70,8D,06,00,AD,10,D0
     DATA29.07.09.18.80.10.00.89
1502
      DATAFF.85,F7,A9,80,85,F8,C6
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      DATAF8, A5, F9, F0, 43, A9, 00, 85
1506
      DATAF2.85.F7.A5.FF.D0.02.E6
1508 DATAFF, 20, 9F, FF, A5, C5, EA, C9
      DATA01, D0. F6, A9, 14, SD, 11, 47
      DATAA9,15,80,12,47,82,00,80
     DATAS9.07.18.DD.92.07.90.15
DATAD0.08.E8.E0.05.D0.F0.40
     DATA25.48.A2.04.BD.89.07.9D
DATA22.47.CA.10.F7.4C.F0.43
DATA4C.DD.43.B8.49.60.17.B5
1520
      DATA19.1E.1A.9C.1C.31.1D.DF
      DATA27, DF, 2A, 3E, 2C, C1, 2F
      DATA32,30,35,39,38,63,38,BE
      DATASE
              4B,43,0F,47,0C,4B
      DATA4F, BF, 54, 7D, 59, 83, 5E, D6
      DRTAFF.00.64.00.00.02.00.00
      DATAGG, 00, A9, 10, 00, 08, 00, 00
      DATA00,00,22,34,75,10,75,00
540
      DRTH00.00.02.34.00.77.FF.00
     DRTH24,02,24,02,24,02,26,02
DRTH24,02,24,02,1F,04,21,02
1544
      DATHIF, 02.21.02.23.02.24.04
1548
1559
     DRTR24,04,24,02,24,02,24,02
      DATA26,02,24,02,24,02,1F,04
DATA21,02,1F,02,21,02,23,02
      DATA24,04,24,04,28,02,29
      DATA28,02,26,02,28,02,26,02
      DATA23,02,24,04,24,04,1F,02
      DATRIF,02,21,02,23,02,24,02
566
      DRTR24.02.26.04.28.02.29.02
     DATA28.02.26.02.24.04.29.04
     DATA24,08,22,02,26,03,26,01
DATA24,02,22,02,27,02,27,02
     DRTR26,02,24,02,26,02,29,02
     DATA29.02.28.02.29.06.26.02
     DATA28.03.29.01.27.02.26.02
     DATA24.02.22.02.21.02.26.02
1589
      DHTH24.02,22,02.22,02.21,02
      DRTR22.06.FF.02.FF
      DATA24,02,26,02,29,02,29,02
      DATA28,02,29,06,26,02,28
     DATA29.81.27.82.26.82.24.82
1599
     DATA22,02,21,02,26,02,24,02
     DATA22.02.22.02.21.02.22.06
DATAFF.FF.FF.FF.FF.FF.FF.FF
1594
1596
      DATAFF.FF.DF.FF.FF.FB.FF.86
      DRTARO.00.C6.ED.10.4F.RS.EE
1500
     DRTR18.69.02.85.EE.90.02.E6
1602
      DRINEF BI FF 10.08,09,48,85
     DRTREF, 89, 80, 85, FE, 40, 71, 49
      DRTHUR. 88.80.04.04.80.08.04
      DATABO.00.48.80.01.04.49.80
      DATAGS. D4. RD. 01 48. SD. 00. D4
      DATASD.07.04.89.78.80.05
      DATASD, 90, D4, 89, 21, 80, 84, D4
      DATAA9, 25.8D, 0B, D4.C8, B1, SE
     DRTROR.00.00.85.EB 40.9F.FF
      DATHAD.76.07.09.15.00.07.AD
     DATAY7.07,09,14,F0,03.40.28
DATA47.05,12.47.AD,12.47.09
DATA12.D0.06.05,11.47.EE.12
      DRTR47.80.03.98.88.ED.81
                                     38
      DATAE9.08.9D.89.07
      D8T807.BD.89.07.40
      DATA10.09.82.04.80.89.07
                                     90
     DOTE:19.47.09.19.F7
1644 DETE*
```



TOADS

VIC TOAD LOADS in four programs and program 1 loads in program 2, 3 and 4 and displays a small title. Program 2 simply relocates the memory to allow for both machine code and graphics. Program 3 loads in the machine code and the graphics for the game. The graphics are held between locations 7168 and 7679 and between 6144 and 6359. There are a number of machine-code routines incorporated in the game.

The machine code held between locations: 6400-6534 scroll the logs on the screen; 5120-5180 scans the screen for the toad and dumps its location in locations 7678 and 7679; 673-730 scans both the keyboard and joystick and dumps the direction you wish to move in, in locations 0 and 1; 7088-7155 is an interrupt which is updated every 1/60th of a second.

The interrupt controls the majority of the sound in the program, making the game very noisy. Program 3 also changes the shape of the screen and displays titles while loading in program 4.

Program 4 is the game. You are the toad at the base of the screen and your objective is to reach the top of the screen. The faster you achieve this the more bonus points you are awarded. If you take too long then no bonus points are awarded.

Graham Lynas leaps into fast-moving action.

You also receive points for travelling up the lift, jumping on logs and reaching the top of the screen.

Use the following keys: W to go up. X to go down. A to go left.

D to go right.

The game is very fast and noisy and it may be a while before you reach the top of the screen, although it doesn't take long to pick up the idea of the game. The game has a number of stages. For example, each time you reach the top of the screen the logs get smaller and, after a while when you really get good at it, the ladders between the logs become invisible.

When you reach the invisible ladders stage
— if you reach the invisible ladders stage —
then the ladders will begin to flash and will
continue to do so until you start to move. This
should give you all the time you need to
remember where the ladders are, but

Program 1.

10 POKE36879,12

20 POKE646,1

30 PRINTCHR\$(147)

40 A\$="LF:R /: LF:R /: ": X=631

45 POKE198,12

50 FORY=1TOLEN(A\$)

60 IFMID\$(A\$,Y,1)=":"THENPOKEX,13:GOTO80

70 POKEX, ASC(MID\$(A\$,Y,1))

80 X=X+1:NEXT

90 PRINT" SECONDARIO DE LA PRINT" SECONDARIO DE LA PRINT" SECONDARIO DE LA PRINT" DE LA PRINT DE LA PR

THE TOAD"

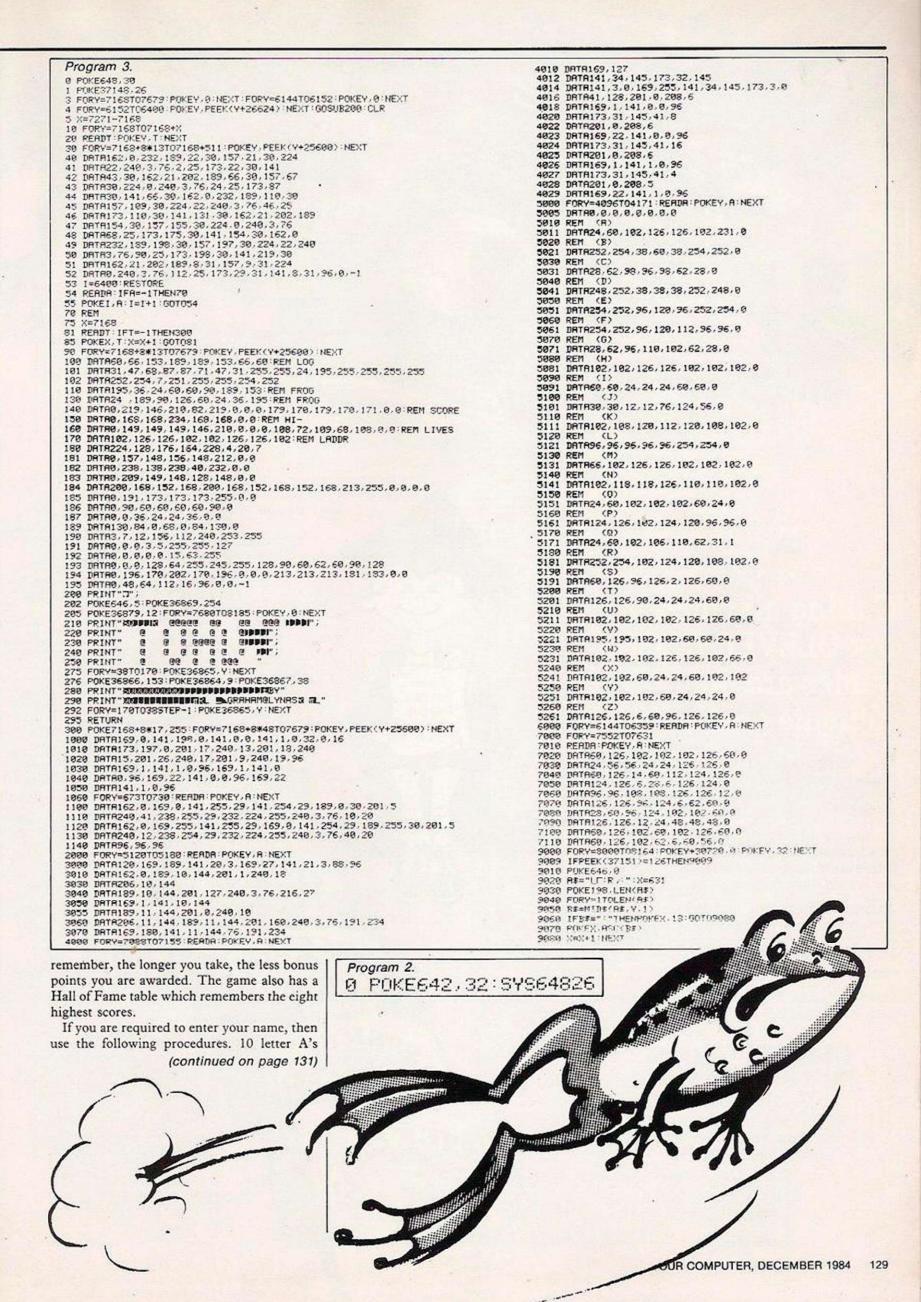
100 PRINT"XX

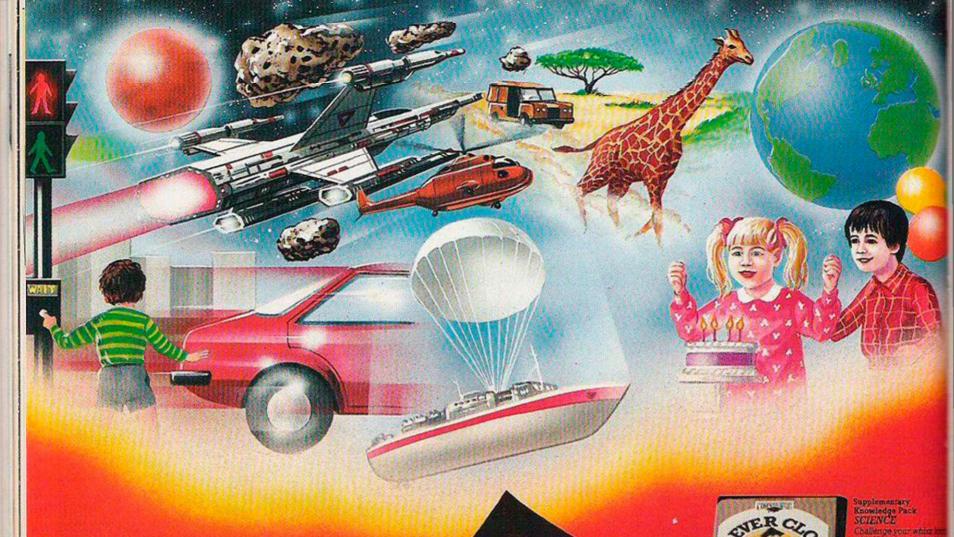
ישם

110 PRINT"

GRAHAM LYNAS"

120 POKE646,0





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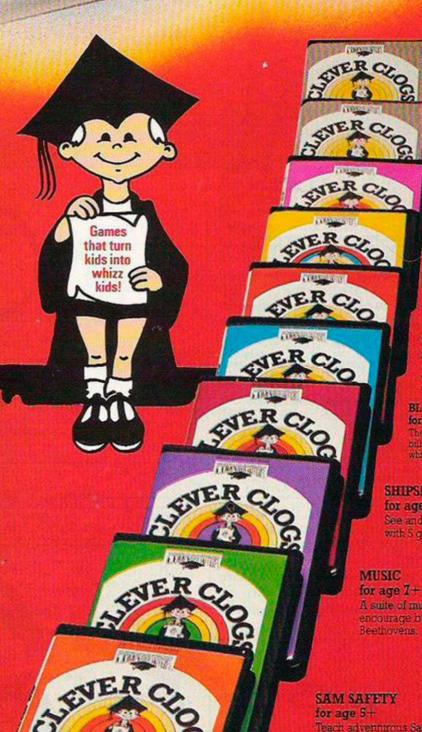
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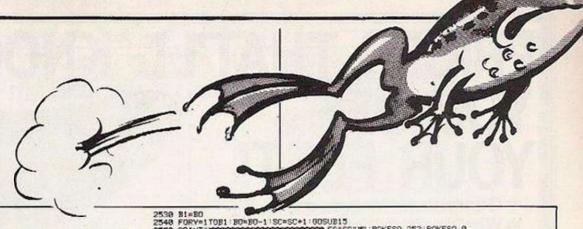
Spectrum £7.95, BBC and Commodore 64 £8.95, Supplementary Knowledge Packs £5.95.

(continued from page 129)

o feams

will be displayed on the screen. Position your toad under the letter you wish to change, using the keys A and D or left and right on the joystick.

When you are ready to enter your name press S on the keyboard or fire button on the joystick. The game occupies asbout 7K and could probably run with 8K expansion although it was designed to run with 16K expansion.



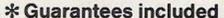
```
Program 4.
                     R(6)=(P+22#12)+7
FORY=1T07:S(Y)=288+V:V=V+7:NEXT:V=8
        32 POKE36869, 255

40 D=4:S=1

41 FORV=PTOP+21:POKEY, 238:POKEY+C, 5:NEXT

42 FORY=8164T08188:POKEY, 238:POKEY+C, 5:NEXT
        $2 R(3)=(7792-823)+FRE(2):R(4)+(7941-821)-FRE(2)
$3 R(3)=7892-82FRE(2):R(6)-R(5)+821
$4 RETURN
$5 FORTH TIDE
$5 FORTH TIDE
$6 FORTH TIDE
$6 FORTH TIDE
$6 FORTH TIDE
$7 FORTH TIDE
$7 FORTH TIDE
$7 FORTH TIDE
$7 FORTH TIDE
$8 FORTH TIDE
$8 FORTH TIDE
$8 FORTH TIDE
$8 FORTH TIDE
$1 FORTH TIDE
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$1 FORTH TIDE
$2 FORTH TIDE
$3 FORTH TIDE
$3 FORTH TIDE
$4 FORTH TIDE
$2 FORTH TIDE
$3 FORTH TIDE
$4 FORTH TIDE
$4 FORTH TIDE
$5 FORWITG PORTH TIDE
$5 FORWITG PORTH TIDE
$6 FORWITG PORTH TIDE
$7 FORTH TIDE
$7 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                     ZC=22
GETHS: IFHS=""AND(PEEK(37151)AND32)<>8THENFORT=1T0188:NEXTT:GOT08268
FORT=1T0388:NEXTT
TU=TU-1:POKETU-4,8:POKETU-3,24+128:POKETU-2,23+128:POKETU-1,25+128:POKETU,5
                                                                                                                                                                                                                                                                                                                                                                                                                                          8282 2C=22
8299 GET##: IF###="#NDKPEEK(37151)AND32)
8290 GET##: IF###="#NDKPEEK(37151)AND32)
8290 GET##: IF###="#NDKPEEK(37151)AND32)
8300 FORT=IT0300: NEXTT
8301 TU=TU=1; POKETU=4,0: POKETU=3,24+128: POKETU=2,23+128: POKETU=1,25+128: POKE
8302 POKES9,230
8303 FORT=IT0500: NEXTT
8306 POKES0+1; 200
8310 POKES0+1; 200
8311 POKES0+1; 0: POKETU=2,24+128: POKETU=1,23+128: POKETU,22+128
8311 POKES0+1; 0: FORT=IT0100: HEXTT
8314 POKES0+1; 0: FORT=IT0100: HEXTT
8314 POKES0+1; 128: POKETU=3,0: POKETU=2,24+128: POKETU=1,23+128: POKETU,25+128:
8320 POKES0+1; 0: FORT=IT0100: HEXTT
8314 POKES0+1; 0: FORT=IT0100: HEXTT
8315 POKES0+1; 0: FORT=IT0100: NEXTT
8316 FORV=TUT0819: POKEY=3,0: POKEY=2,24+128: POKEY=1,23+128: POKEY,25+128:
8327 FORT=IT0300: NEXTT,9
8330 HS=HS(1): SC=0: POKES9,149: FOKE7142,150: POKEY-1,23+128: POKEY,25+128:
8327 FORT=IT0100: NEXTT,7
8330 HS=HS(1): SC=0: POKES9,149: FOKE7142,150: POKEY-1,23+128: POKEY,25+128:
8327 FORT=IT0100: NEXTT,7
8330 HS=HS(1): SC=0: POKES9,149: FOKE7142,150: POKEY-1,23+128: POKEY,25+128:
8328 FOK=100: NEXTT,9
8330 HS=HS(1): SC=0: POKES9,149: FOKE7142,150: POKEY-1,23+128: POKEY,25+128:
8320 POKES9-44,9EEK(PS-44)=1: FOKET: GOTO00
8320 FOKES9-44,9EEK(PS-44)+1: RETURN
8320 FOKESP-44,PEEK(PS-44)+1: RETURN
8321 POKEPS-44,PEEK(PS-44)+1: RETURN
8322 RETURN
8323 ROW=POKES9,0: P3=8175: P4=230: PS=5: GOTO100
8320 POKES9,0: P3=8175: P4=230: PS=5: GOTO100
8320 POKES9,0: P3=8175: P4=230: PS=5: GOTO100
```

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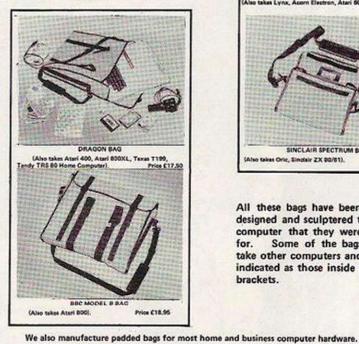
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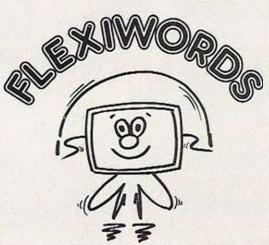


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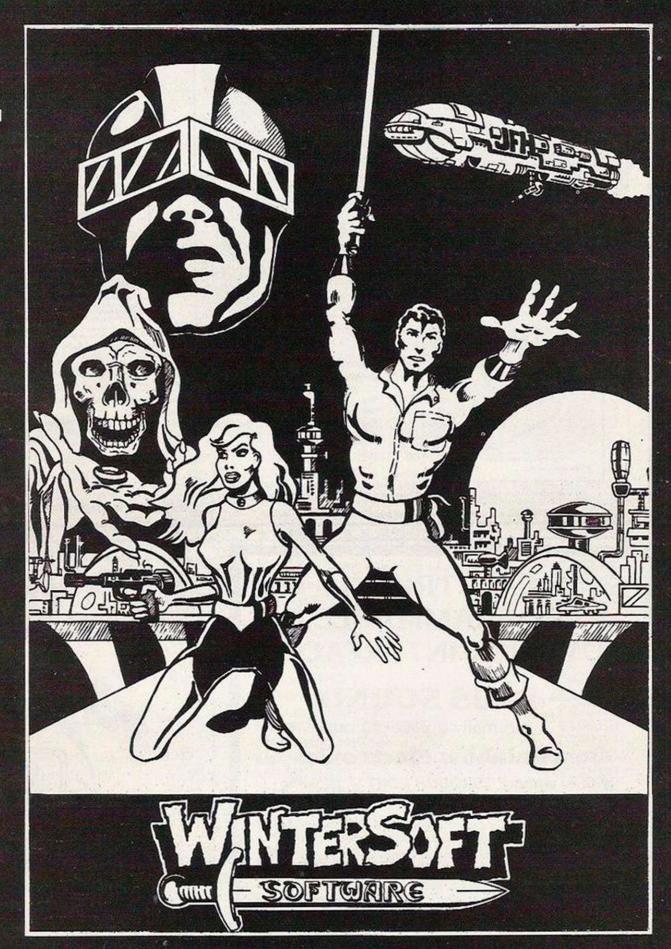
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JUAN CHECLOSE MY CHECO DORESS:

Julian Wood and a maze game with a difference for the Spectrum.

UFO IS AN ORIGINAL game for the 16K or 48K Spectrum. It is written entirely in machine code and is therefore very fast. The general idea of the game is as follows:

You, a poor undefended human have been sent against a lethal race of aliens who follow you around the screen. The only way you can kill an alien is to collide with an energy block—the stationary object on the scren—which gives you enough power to kill one, and only one, alien. Once you have killed an alien, if you go to the bottom of the screen without hitting anything and then press the down key, the dead body of the alien will appear at the bottom of the screen.

Once the time — shown as TI at the top of the screen — reaches zero, the number of dead aliens at the bottom of the screen gives you a bonus added to your score. With each screen only a certain maximum number of aliens will appear, and once you have killed all these, another batch will appear.

After each screen the maximum number of aliens is incremented up to a maximum of 10. The keys for moving the human are:

6 = left, 7 = right, 8 = up, 9 = down, 0 = halt of the game.

To enter UFO, first type in the Basic program in listing 1, and save it using SAVE "UFO" LINE 0

and then verify it. Next, enter the machine code loader program in listing 3, and run it. Enter the machine code as in listing 2, and the screen output should tally with the listing. If you make a mistake enter -9 and enter that line again. If you enter a ridiculous number - greater than 255 - you will hear a beep and you should enter that number again.

Once you have entered all 1663 bytes of machine code, save it using

SAVE "c" CODE 24500,1663 and verify it. Finally check that the program is OK by loading the UFO Basic program which should load and run the main program.

After playing UFO for a while you may find it too easy or hard. I have therefore shown various locations — in figure 1 — which you can change to suit your needs by Poking. The initial contents of the location are shown in brackets. To change a value of a location, just load the code, Poke the location and

Figure 1. RAND USR 25807

Speed = 25922 (20). Time speed = 25915 (3).

Lives = 25839 (3). Max. number of aliens = 25689 (10).

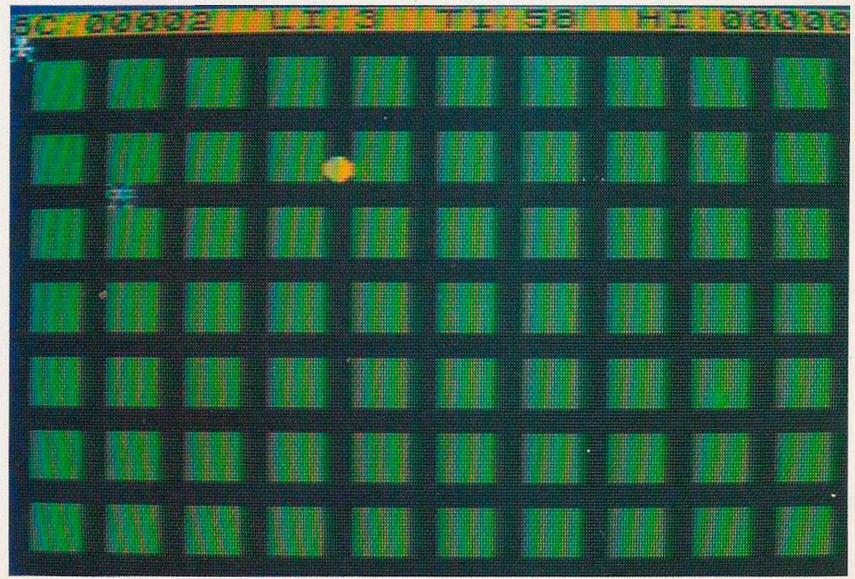
If you are still unconvinced of how essential sound is in games, then try the following: POKE 24500, 201: POKE 25114,201.

Hear the difference?
Furthermore, try Poking 24775, 201,
(continued on page 137)



Listing 1.

10>POKE 23697,0: POKE 23693,9:
BORDER 1: CLS : LET as="UFO IS
LOADING": FOR a=7 TO 0 STEP -1:
BEEP .02,a+18.5: PRINT AT 11-a,9
; INK 6;as;AT 10-a,9,,AT a+11,9;
as;AT a+12,9,; BORDER a: NEXT a
20 BEEP .5,17.5: BEEP .5,19.5:
BEEP .5,15.5: BEEP .5,7.5: BEEP
1,10.5: FOR a=22888 TO 22903 ST
EP 2: POKE a,178: POKE a+1,150:
NEXT a: LOAD ""CODE : RANDOMIZE
USR 25807





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BBC/Electron Classic Adventure	*	*				*		£6.95

versions of 'The Hobbit' are identical with regard to the adventure ogram. Due to memory limitations. BBC cassette version does not clude graphics.

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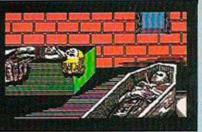
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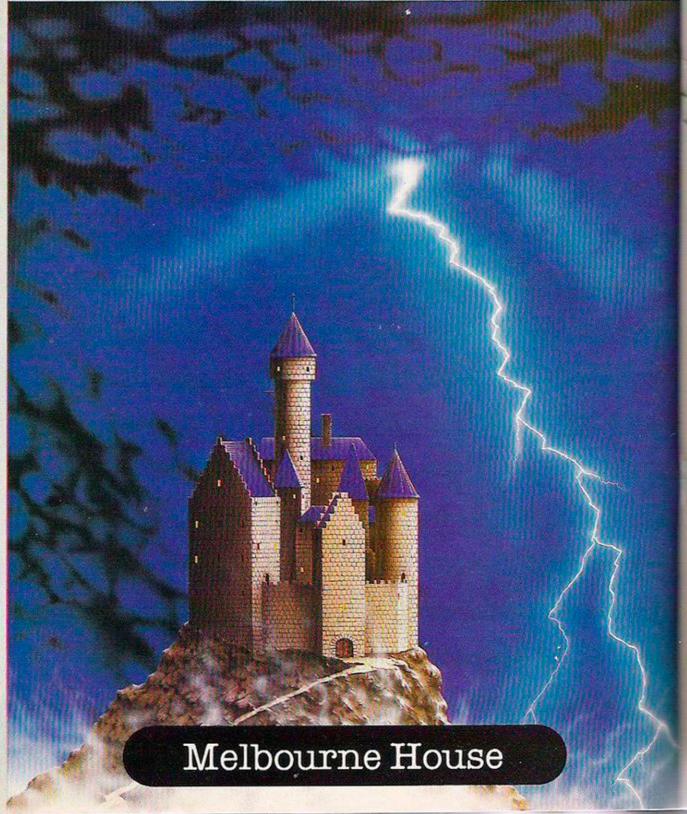
Castle Of Terror is a suberb graphic adventure game set in the 1880's when and where "Dracula" stories abounded. You are in a village near a large Castle in which the secretive Count lives. You must travel about the village, collecting items which may be of use to you on your bold mission.

You must also find out what your mission is by talking to the right people. But don't be fooled!

- ★ Multi-word "English Language" style input
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Surviving is success enough, but escaping with the treasure is the ultimate achievement and won't be easily accomplished!

CASTLE : of : TERROR



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25135:229
25140:61
25145:6
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                                                                                                                                                                                                                                                                                                                                                                                                                            =24500 TO 26163 STEP
                                                                                                                                                                                                                                                                                                                                                                                                                                                                    20 PRINT a; ": "; :
                                                                                                                                                                                                                                   143 = 51854
80 = 52072
32 = 52421
57 = 52755
79 = 53058
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              LET
                                                                                                                                                                                                                                                                                                                                                                                                                            b=0 TO 4
         25070 32 32 32 32 32 53560

25075 2 0 21 0 1 =53564

25080 71 32 32 32 154 =53905

25085 54 32 32 32 55 =54110

25085 153 32 32 32 35 57 =54719

25095 156 32 32 32 32 57 =54719

25105 61 72 65 76 64 =55015

25110 32 32 32 32 46 =55015

25110 32 32 32 32 46 =55015

25110 32 32 32 32 46 =55015

25110 32 32 32 32 46 =55015

25110 32 32 32 32 46 =55373

25110 32 32 32 32 46 =55373

25110 32 32 32 32 46 =55373

25110 32 32 32 32 46 =55373

25110 32 32 32 32 46 =55373

25110 32 32 32 32 46 =55373

221 =55094

25120 123 178 200 221 110 =56926

25130 4 0 221 9 221 =57710
```

```
2112
                                C = 0:
                                  d = C :
30 INPUT "Byte? ";n: IF n>255
THEN BEEP .5,20: GO TO 30
40 IF n=-9 THEN LET c=d: LET
=a-(5*NOT b): PRINT : GO TO 20
   50 LET c=c+n: POKE a+b,n: PRIN
 TAB b*4+6; n; : NEXT b: PRINT TA
B 26; c: NEXT a
```

Amstrad's new CPC464 comes with plenty of free plugs. Sophisticated and complex programs

CPC 464
complete
with
monitor
datacorder

CPC464 green screen VDU (GT64)

ou may have noticed that the press got very excited about our new comer system.

nd rightly so.

ecause the new CPC464 comes aplete with its own green screen U or colour monitor, built-in cassette recorder, 64K of RAM, 32K of M, typewriter style keyboard and a fast extended BASIC.

henyouconsiderthat the complete puter system including green en VDU and cassette data recorder only set you back £249, that's plenty et excited about.

ou can use the green screen version e CPC464 with a colour TV by connecting the optional power supply and modulator (MP-1).

"I think the Amstrad will give a lot of sleepless nights to Sinclair, Acorn and Commodore..."

POPULAR COMPUTING WEEKLY

Other micros can't get anywhere near the CPC464's memory for the price. Over 42K is available to users, thanks to the implementation of ROM overlay techniques.

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And the CPC464 offers you high resolution graphics, 80 column text display, up to 8 text windows, a graphics window and a palette of 27 colours.

"The CPC464...
in two boxes and one lead includes a list of features that would shame a hybrid of the major machines."

PERSONAL COMPUTER WORLD

One of the most obvious is the quality of the on-screen graphics. Quite simply, the CPC464 beats the micro/domestic TV combination out of sight.

That's because our monitor drives each colour on the screen directly from the computer. Nothing gets in the way of the best possible picture. And you won't have tuning problems, either.

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A fast growing range of Amsoft programs is already available.

The high quality software takes full



advantage of the CPC464's high specification and speedloading capability. Which means even complex programs can be loaded quickly.

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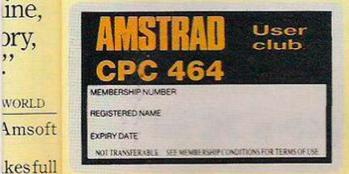
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like the privilege card, Club binder, regular magazine, competitions for valuable prizes and contact with other Amstrad users.

"The Amstrad machine provides a lot of other features for a very low price."

GUARDIAN

At Amstrad, we're constantly looking to the future. That's why the CPC464 has a built-in parallel printer interface. A low cost optional disk drive system including CP/M* (with the option to access 3000 programs) and LOGO. A joystick port. And the virtually unlimited potential of the Z80 data bus with sideways ROM support.

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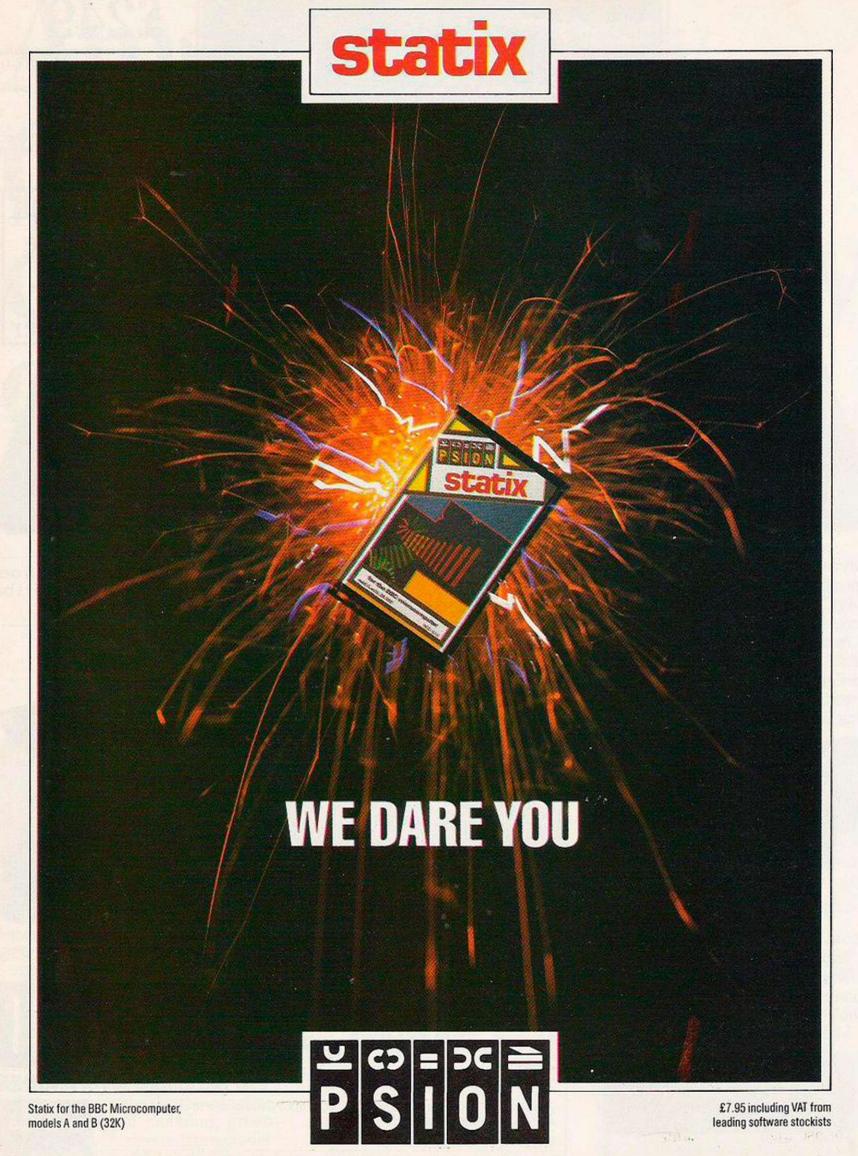
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Protek Computing Ltd, 1A Young Square, Brucefield Industrial Park, Livingston, West Lothian. 0506 415353. I WANTED A PROGRAM that would enable me to alter the Env and Ent variables easily and quickly and then be able to hear them. I also wanted to see what the envelopes looked like, without having to resort to Pen and Paper to draw it each time.

The program I ended up with is just over 14K long. You can even use the keys like a music keyboard and once the sounds have been defined you will have a music synthesiser.

I've used plenty of Rem statements throughout the program, so I won't go into detail and describe what each part does. It is possible to move quite freely about within it when running.

After typing in the program, Run it and you will be in screen 1. This is the title page and there are five pre-defined sound on it. You can define up to nine sounds, the first five are not permanent, so these can be altered quite easily but for now type in 1 and enter it.

When you press the Y key will first get a prompt to enter your title. After you enter this title you will be asked if you want Noise, Play or both enter one of these by pressing the N,P or B key. The next prompt is for repeat on the tone, enter Y or N. These prompts and title are purely for your own reference and in no way effect the program.

You should still be at the point in the program where the computer is waiting for you to answer it. Do you want to add a new title? Press N for no. You will now see a plotted graph - in white - of the volume envelope - screen 2. In the bottom left hand corner is the scale and the finished step. The scale can be altered by pressing D or M. The D will divide the scale by 2 and the M will multiply it by 2.

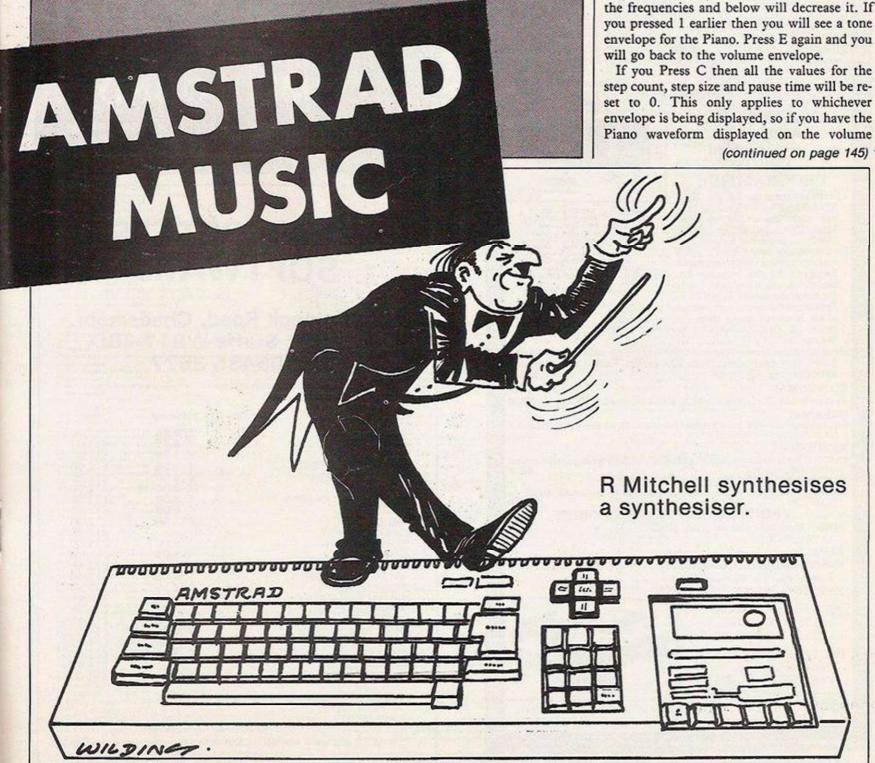
When you start working on your own volume or tone envelope and the plotted shape goes outside the graphic window then by pressing the D key you will see the graph re-plotted at half the original scale. The same applies when the plotted graph is too small by pressing the M it will be re-plotted at twice the original scale.

The finished step tells you where you are in relation to the 0 volume level. On the bottom right hand side is the tone and volume time. This tells you how long the note you are designing will last and how much of it will be affected by the tone.

If you typed in 1 earlier you should have displayed on the screen what I think a Piano waveform will look like. There are two horizontal lines, the bottom one - green - is the 0 volume level and the top one - red - is the 15 volume level - maximum. If you go above the top line you will get some unusual effects, also the section step total at the top of the screen will change from red to green.

At the top of the screen are the step count, step size and pause time, with a green arrow pointing to the first one. As you enter new values for this the arrow will move to the next one. The program will check to see if the values are correct each time you enter one, the arrow is controlled by using the cursor keys.

Press T and you will go to the tone envelope, this has one horizontal line and you can plot above or below it. Again in the bottom left hand corner is the finished step which tell you where you are in relation to the original frequency. Above this line increases the frequencies and below will decrease it. If you pressed I earlier then you will see a tone envelope for the Piano. Press E again and you will go back to the volume envelope.



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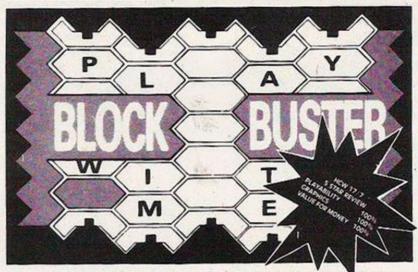


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STANDS

(continued from page 143)

envelope screen - screen 2 - and press C then this is the only one to be affected, it will not reset the tone envelope unless you are displaying it.

Commands for screen 2.

 C — To clear the variables.
 T — to display the tone envelope shape and input new values.

E - to display the volume envelope and input new values.

M — to multiply the plotted graph by

 D — to divide the plotted graph by two.
 R — to return to the title page screen 1.

cursor keys to move the input arrow.

P - to play the note or noise - screen 3.

You are now ready to play a note so press the P key. This will take you to screen 3. This is the last screen and you will have displayed in front of you the instructions for playing a note or noise. But I will run through them

O - this tells the computer that you wish to use the noise and note the period.

P - this plays a sound using the period part of the sound command. E - return to the volume envelope graph and input mode - screen 2. return to then tone envelope and graph input mode - screen 2.

R - return to the title page - screen

cursor keys up and down, to increase or decrease the octave or noise level.

+ — this will put the tone on repeat.

- — this will remove the repeat from

Q - this will automatically repeat the last note or noise played and keep on repeating it.

the left and right cursor keys will increase or decrease the speed at which the repeat occurs at. W - this will cancel out the auto-

1 to 9 — By pressing these keys you are able to play another sound envelope, press 4 and you will get the Phaser envelopes to play, press 1 and you will get the Piano envelopes.

repeat.

All the input commands are in the lower case, so don't use the Caps Lock or Shift keys.

On the left hand side just below the instruction on screen 3 you will see all the relevant information about the note or noise just played. Frequency, Period, Octave, Noise, Noise Range, Note Length - time, tone - vibrato - and name, as defined in the title page of the instrument or sound effect. So once you find the correct period or frequency of the note or sound effect that you are after, you only have to write it down. For example, Noise 6, and then press the T or E and write down the values you use in these two, step count, step size and pause time for each section and then you are ready to put them into your own program.

It is possible to use the keyboard to play a note across nine octaves, one octave at a time and you can play up to three notes at one time but only one noise. All the times that are displayed are in seconds.

I've used integer variables as much as possible to increase the speed and save some memory. If you want to make the tone envelope repeat in your own program don't forget to use a negative number when you define it e.g.:

ENT -2 or ENT -1 etc.

To alter the colours of the display: COL% PAPER, COL2% PEN 1, COL3% PEN 2, COL4% PEN 3

If for any reason you break out of the program then type in Goto 520 and you won't lose any of the variables that you have already entered.

Finally, Enter the following values into the tone envelope for the Piano.

Step count 1 10 Step size 20 Pause time

Use octave 2, 3 or 4. All I'll say is it comes from India. Put a Rem on line 90 On Error Goto until the program is free from typing errors. Delete line 150 when everything is O.K. If you press the small Enter key, it will reset the colours and key speed.

```
="No Repeat"
"Receat on"
"Receat on"
  repeat on"
270 titles(5)="SYBOLS-----":nes(5)="Noise":rs(5)
="No Repeat"
550 CLS:PEN 1
560 FOR ax-2 TO 18 STEP 2
570 LOCATE 1,ax:PEN 3:PRINT ax/2;:PEN 1:PRINT" = ";tit
lef(ax/2)
590 LOCATE 25,ax:PRINT nsf(ax/2):NEXT
590 LOCATE 10,23:INFUT"HOWEFORM No.";wnoX
510 IF wnoX(1 OR wnoX)20 THEN 600
620 CLS:LOCATE 1,15:PRINT"DO YOU Mish To Add Another T
itle V/N ?"
630 as=INFUEYS:IF as=""THEN 630
 itle V/N ?"
630 as=INKEYs:IF as=" THEN 630
640 IF as="y"THEN 660
650 GOTO 860
660 LOCATE 1,15:PRINT SPACES(40)
670 PEN 2:LOCATE 5,12:PRINT*ENTER A MAXIMUM OF 17 LETT
ERS*
 ERS*
480 PEN 1:LOCATE 11.5:PRINT*
590 PEN 3:LOCATE 11.5:LINE INPUT title#(smoX)*
700 title#(smoX)*[title#(smoX)**
710 PEN 1
720 IZ=LEN(title#(smoX)*
730 IF 1%)17 THEN title#(smoX)*LEFT#(title#(smoX).17)*
740 title#(smoX)*UPPER#(title#(smoX))*
750 LOCATE 5.16:PRINT*(N) Noise (F) Play (B) Both*
```

```
1030 LDCATE 125,25:PRINTTONE time":
1040 LDCATE 1,25:PRINTTFinished step=";
1050 LDCATE 1,25:PRINTTFinished step=";
1070 PRINT 50:01E 2000:COSUB 2190:COSUB 1590
1090 CDSUB 2000:COSUB 2190:COSUB 1590
1090 CDSUB 2000:COSUB 2190:COSUB 1590
1100 REM email for the seminary state of the semi
```

```
1630 IF entwi THEN FRINT ve(wnoX,x1X,y1X);" "
1640 IF entwi THEN PRINT te(wnoX,x1X,y1X);" "
1630 NEXT:NEXT
1660 PEN 3:FDR x1X=1 TO 5
1670 LOCATE x1X=5:11,y1X+1
1680 IF entwi THEN PRINT ve(wnoX,x1X,1)*ve(wnoX,x1X,3)
/100: ";
1690 IF entwi THEN FRINT te(wnoX,x1X,1)*te(wnoX,x1X,3)
/100; ";
1700 NEXT
 7/00; ":
1700 NEXT
1710 IF en%=1 THEN 605UB 1790
1720 IF en%=2 THEN 605UB 2080
1730 LOCATE 35,24:PRINT USING "££.££"; voltime/100;
1740 LOCATE 35,25:PRINT USING "££.££"; totime/100;
 (listing continued on next page)
```

(listing continued from previous page)

IPPINT"-(T)"; PEN 2:PRIN
T=TONE";
2530 PEN 1:PRINT" (+)"; PEN 2:PRINT" TO RENOVE REPEAT";
PEN 1:PRINT"(-)"; PEN 2:PRINT" TO RENOVE REPEAT";
2540 PENIT" USE ":PEN 1:PRINT CHRS (240); PEN 2:PRINT" TO INC. AN
D DEC. FREQUENCY";
2550 PEN 1:PRINT:PRINT"(0)"; PEN 2:PRINT" TO REP
EAT SOUND ":PEN 1:PRINT"(W)"; PEN 2:PRINT" TO CANCEL
REPEAT";
2560 PRINT" USE ":PEN 1:PRINT CHRS (242); PEN 2:PRINT
TO INCREASE AND ":PEN 1:PRINT CHRS (242); PEN 2:PRINT
T" TO DECREASE"
2570 PRINT" SPEED OF REPEAT"
2580 LOCATE 11,11:PRINT"PRESS ":PEN 1:PRINT"CP1"; PEN
2:PRINT" FOR NOTES"
2:PRINT" SPEED OF REPEAT"
2:PRINT" FOR NOTES"
2:PO LOCATE 17,13:PRINT"Z = C":LOCATE 17,14:PRINT"D =
DE"
2:C0 LOCATE 17,17:PRINT"X = D":LOCATE 17,16:PRINT"D =
DE"
2:C1 LOCATE 17,17:PRINT"C = E":LOCATE 17,18:PRINT"V =
E"
2:C2 LOCATE 17,19:PRINT"S = EC":LOCATE 17,19:PRINT"V =
E"
2:C2 LOCATE 17,19:PRINT"S = EC":LOCATE 17,20:PRINT"D =

2620 LOCATE 17,19:PRINT'S - FC":LOCATE 17,20:PRINT'B -

2630 LOCATE 17,21:PRINT"H - GC":LOCATE 17,22:PRINT"N =

A" 2640 LOCATE 17,23:PRINT"J = AC":LOCATE 17,24:PRINT"H =

2550 LOCATE 29,23:PRINT*TONE*
2660 609UB 3710:rpt=1:LOCATE 27,25:PRINT*No Repeat*
2670 609UB 3490
2670 609UB 3490
2670 6197902:137:a2=7458.621:a1=7040:g2=6644.875:g1=62
71.927:f2=59:9.91
2679 f1=5927.692:e1=5274.041:d2=4978.032:d1=4698.636:c
==4434.922:c1=4186.009
2700 n1X=1:n2X=2:n3X=3:n4X=4:n5X=5:n6X=6
2710 6070 2720
2720 609UB 3820
2730 IF sond=1 THEN LOCATE 1,23:PRINT*OCTAVE*:19=oc=4:
2740 IF sond=2 THEN LOCATE 1,23:PRINT*Noise=*!nos:* ":
2750 609UB 3420

3570 ENT rpt,te(wno%,1,1),te(wno%,1,2),te(wno%,1,3) 3580 8818 3670

3570 ENT rpt,te(wnoX,1,1),te(wnoX,1,2).te(wnoX,1,3)
3590 ENT rpt,te(wnoX,1,1),te(wnoX,1,2).te(wnoX,1,3).te
(wnoX,2,1),te(wnoX,2,2).te(wnoX,1,2).te(wnoX,1,3).te
(wnoX,2,1),te(wnoX,2,2).te(wnoX,2,3).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,1).te(wnoX,1,2).te(wnoX,1,1).te(wnoX,1,2).te(wnoX,1,3).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,2,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,2,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,2,2).te(wnoX,2,2).te(wnoX,1,2).te(wnoX,1,2).te(wnoX,2,2).te(

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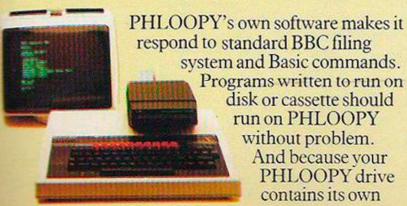
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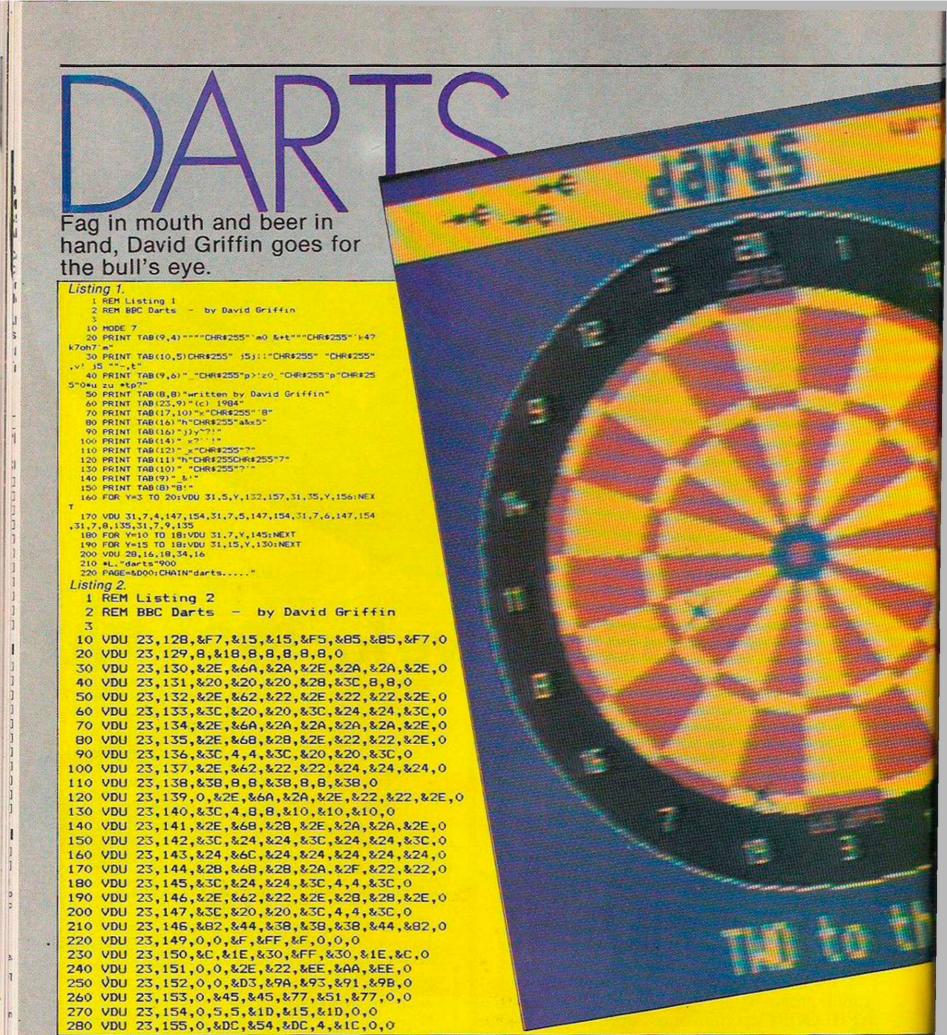
0	rd	er	F	rn	1

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DARTS IS A GAME for the BBC model B or 32K model A, and although not tested will probably work on an Electron.

The game of darts once only played in its traditional home of the pub and club is now an international sport frequently seen on television. It is one of the most popular participant sports in this country, and indeed the world, played by millions.

My computerised version is by no means a substitute for throwing arrows from the oche down at your local but an alternative to arcadetype games requiring manipulation of at least 11 of your fingers and very quickly, a feat not suitable for some of the more elderly BBC users!

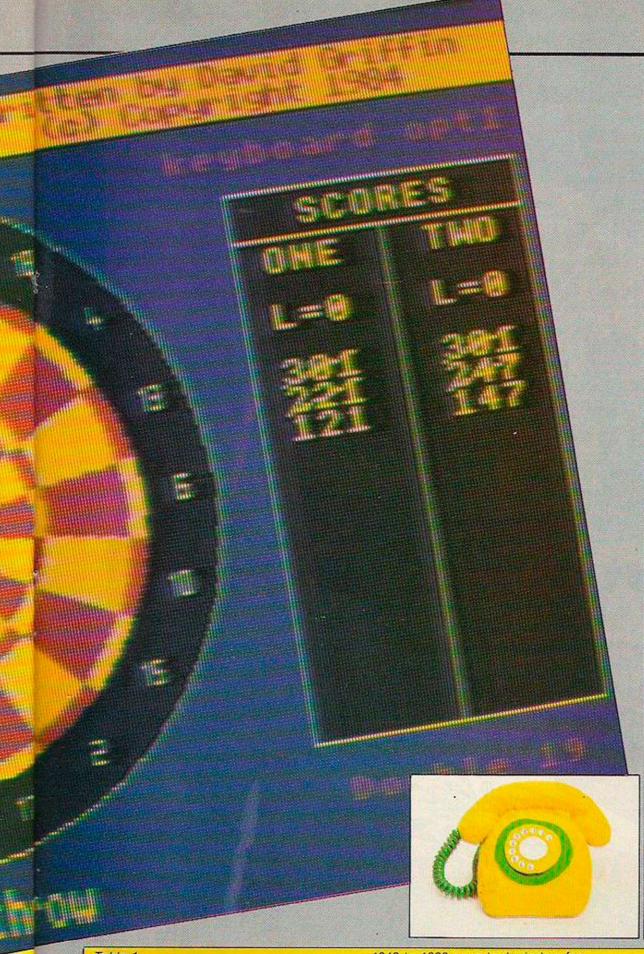
It is difficult to emulate the same skills of the darts game proper on a computer game and so the method of aiming and throwing darts I have employed is to manoeuvre a crosshair sight over the board, throwing a dart when it is over the place you want. A skill element is introduced with the sight drifting and so making it more difficult to hit the number you require. The game was written with joysticks in mind although I have provided for keyboard

use

There are three different games to play in my program, the standard game, around the clock and all fives. All are for two players.

The standard game — options 1 and 2 on the main menu: Option 1 provides a standard 301 game with double start and double to finish, played over five legs, i.e., the first to win three games wins the match. The difficulty level decides how much the sight drifts, level 1 is the

After the board has been drawn both players should enter their initials or three lettered



pseudonym. The scoreboard shows initials, how many legs each has won — shown by 'L=' — and the score required for this game.

As each dart has been thrown the display to the bottom right of the screen shows what it has scored.

Option 2 allows the parameters to be altered, giving games such as 801 straight off over 3 legs and 101 double start over 9 legs.

Around the clock — option 3: In this game each player goes around the board, throwing at 1 until hit and then at the 2 etc. and ending on the outer bull — 25 — and then the bull's eye — 50. It is possible to aim for singles, doubles or trebles depending on your initial choice. The score-board shows what each player must throw for next, with sgl, dbl or tbl printed under initials.

All fives — options 4 and 5: Option 4 gives the standard all fives game. Each player must score a multiple of five for his three dart total throw, for example: 55, 25 etc. If he misses the board with one of his darts the throw is not counted. Then the number of fives scored is calculatled, that being his score for that throw — a score of 45 counts as 9, 10 as 2 etc. — and taken from his initial 51 points. A throw resulting in a score that is not a multiple of five is not allowed. The match is over five legs.

Option 5 allows parameters to be changed, so the game can become all threes or all eights etc.

An unusual feature in the programming of darts is the use of two Basic programs resident in the machine at the same time, the main game - listing 4 - and a routine to draw the dartboard - listing 3. The reason for this was to allow myself an extra three pages of programming space. The memory soon got full while developing the game although relocating Page to &D000. I couldn't start the Basic program below this because of the user-defined characters stored between &C00 and &CFF, so I chopped part of the main program off and stored it between &900 and &BFF, this area is free when files, RS-423 and function keys are not used. Then Page only needs to be changed to pass control from one program to the other. See line 60 of listing 3 and line 80 of listing 4.

To enter the program and store it on cassette in the correct order, the following procedure should be followed:

type in listing 1

save with 'SAVE "DARTS" (RETURN) (RETURN)

type in listing 2 and RUN it

(continued on page 151)

from keyboard or joystick

Table 1. 10 to 150 main control program 80 jumps to small program stored between &900 and &BFF to draw dartboard 160 to 550 standard game and all fives routine 330 all fives missed a dart 360 all fives not a multiple of five 380 fanfare on 180 400 cross off old score 560 to 860 Around the clock routine 770 hit bull's eye 780 hit outer bull 810 cross off old score and print new score 870 to 950 get players' names 960 to 1030 get word at position (X,Y) of length L

1040 to 1060 open text window for player P's socreboard 1070 to 1090 close above windows 1100 to 1240 throw three darts routine 1110 print marker darts 1190 check for individual game end of throw 1210 to 1230 rub out darts 1250 to 1480 throw a dart 1270 to 1350 move sights until fire pressed 1380 print dart 1390 work out distance and angle of dart from the centre of the board 1410 find which number dart has hit 1490 to 1510 see if space bar or fire pressed to throw a dart

1520 to 1570 get movement of sight

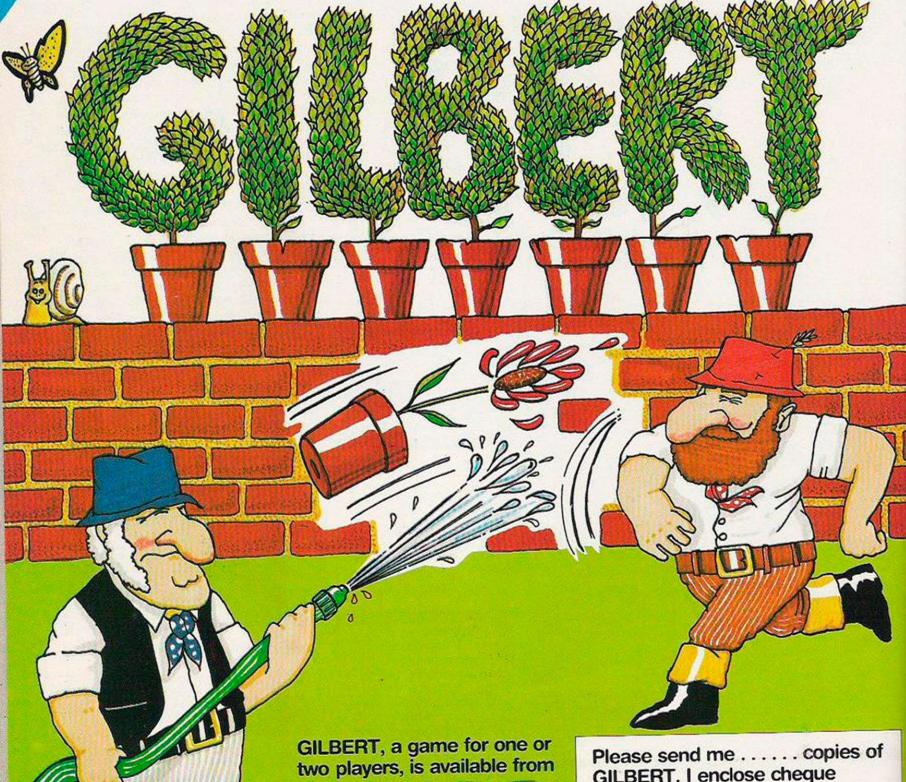
1580 to 1680 additional trimming for dartboard display 1690 to 1770 set up variables and arrays 1720 to 1740 put SINs and COSs in arrays for fast circle drawing 1750 to 1760 order of numbers around dartboard 1780 to 1880 draw sight 1819 to 1910 print M\$ in double height at (X,Y) in colour C 1850 see User Guide p462 1920 to 1940 wipe out n characters at (x,y) 1950 to 1970 delay for t seconds 1980 to 2020 print 'press space bar' 2030 to 2410 instructions and menus 2420 to 2450 get key but only one of those characters supplied by K\$



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(continued from page 149)

- type 'PAGE = &900 (RETURN)'
- type in listing 3
- save with "*SAVE "darts" 900 DOO (RETURN) (RETURN)'
- type 'PAGE = &D00 (RETURN)'
- type in listing 4

Listing 4.

SOPROCHOARD 60PROCSET 70*FX200 1 80PAGE=8900:60T010

save with 'SAVE "darts . . ." (RETURN) (RETURN)

Important - omit lines 1, 2 and 3 from each program.

I would advise saving listing 2 on a back up cassette. In case of deformed characters it will be possible to track them down and repair them.

It would be helpful to replace line 10 of listing 4 with

10MODE7:ON ERROR MODE7:REPORT: PRINT "at line"; ERL: END

1 REM Listing 4 2 REM BBC Darts - by David Griffin

90-FX200 0 (901F g=1 PRDCSgame(301,1,3,H) 1101F g=2 PRDCSgame(5,D,L,H) 1201F g=3 PRDCACIOCE 1301F g=41g5=51PRDCSgame(51,0,3,H) (401F g=51g=41g5=51PRDCSgame(51,0,L,H)

70PR0CGnames (80Pleg(0)=0:Pleg(1)=0:Pl=RND(2)=1:LES=0

180Ping(0)=0:Pleg(1)=0:P1=RND(2)=1:LES=0 190REPEAT 200LEG=LES=1 2:00RC R=0 TO 1 2:00RC P=0 TO 1 2:00RC P=0:Start(P)=SD 2:00RC 0URITO:PRINTTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTAB(29+P+6,10)*L=*;Pleg(P): 2:00RC 0URITO:PRINTAB(29+P+6,10)*L=*;Pleg(P):PRINTAB(29+

MODE7: ON ERROR RUN

60DEFPROCEgame (G,SO,L,H)

PI-1-PILP-PI REPEAT

while the game is developed to trap any typing errors.

SOMBDE 1 40VDU 23:8202:0:0:19.0,4,0.0.0,19.2,0,0,0,0,19.3.

effort and strain of a couple of hours at the keyboard, send £3.75 or £2.75 plus blank cassette plus S.A.E. to David Griffin, 31 Apsley Road, Oldbury, Warley, West Midlands B68 0QY. The game is also available on Prestel via the pages of Viewfax 258. Listing 3.

1 REH Listing 3
2 REH BBC Darts - by David Griffin

For a complete working copy, without the

IOCOLDUR2:COLDURI3:VBU31,6,1,149,150,31.5,2,149,15
0,5:GCDL0,2:HOVEB0,972:VDU149,150:GCDL0.1:#2FEO-"writ
ten by David Oriffin":FORIX-OT023:HOVE024=IX*24,788:VD
UIX782FEO:NEXT:882FEO="(c) Copyright 1984"
20FORIX-OT017:HOVE078*1X*24,736:VDU1X782FEO:NEXT:CD
LOURI20:VDU29,448:512:
20FNCC(308,2,2):DCDL0.3:HOVE0,388:FORIX=OT040;DRAW
388*S(IX),388*C(IX):NEXT:PROCC(300,1,3):PROCC(280,5,1):PROCC(184,1,3):PROCC(184,1,3):PROCC(12,1,1):PROCC(12,1,1):PROCC(184,1,3):PROCC(12,1,1,1):PROCC(12,1,1,1,1)

1.1)
GCCCLO, 3:FDRIX=OTO388TEP2:HOVES48*S(IX)=16.748*C(IX)+16:VDU128*IXDIV2:NEXT:CCCLO, 1:HOVE=32.332:VDU151.15
2:MOVE=44, -300:VDU153, 154, 155, 29, 0;01:CCCLO, 2:HOVE996.
200:DRAM1248, 200:PLOTES: R96, 832:PLOTES: 1248, 832:DRAM1248, 200:DRAM1248, 200:DRAM1248, 200:DRAM1248, 832:DRAM1046, 872:DRAM1248, 700:HOVE976, 816:PRINT*SCORES*IVOU4:HOVE996, 776:DRAM1248, 776:HOVE1072, 776:DRAM1272; 200:GOPAGE*SDD0:GOTO90
700EPFRDCC (RX, CX, DX) DX=CX+DX:CCCLO, CX:HOVE0, RX:FCRIX=17040; IX;17040; IX;1

BORNAWO,O.F.LOTRS, RX+S.(IX), RX+C.(IX): NEXTEENDERDC

290P=1-F

300PRDCw(13,8,29)

310PRDCw(PM:(P)+* to throw*,10,29,3)

320sc=RNdarts(H)

320lf-gr4 schec/g5: IF s=0 PRDCw("MISSED DNE",33,28,3
):PRDCdel(1): PRDCw(10,29,28): G070 440

340IF (ctart(P)=1 AND Bill=0): DR(PS(P)=sc=0 AND db1=0)
):AND gc>4 PRDCw("ND DDUBLE",34,28,3): PRDCdel(1): PRDCw(10,29,28): G070 440

350IF (PS(P)=sc=1 AND gc>4) OR PS(P)=sc<0 PRDCw(50,29,28): G070 440

350IF (PS(P)=sc=1 AND gc>4) OR PS(P)=sc<0 PRDCw(50,29,28): G070 440

350IF gr4 AND sc>1NTsc PRDCw(10,29,28): G070 440

350IF gr4 AND sc>1NTsc PRDCw(10,29,28): G070 440

370IF sc=0 G070440

380IF sc=100 DDUND 1,1,50,50

370IF sc=0 G070440

380IF sc=100 DDUND 1,1,50,50

370PRDCw(15,20,20=sc)-STR(sc),34,28,3)

400GCDL0,3;HOVE(29=Ps()-SC,34,28,3)

400FDCw(PS(P)=sc
420PRDCw(PS(P)=sc
420PRDCw(PS(P)=sc
420PRDCw(PS(P)=sc
420PRDCw(F)=) PS(P)=sc
430PRDCw(F)=0 OR PS(I)=0

470FROCE(PNE(P)** Won the "minatube of the first of the f

to the

570PROCGNAMES BBOFDR P=0 TO 1:PS(P)=1 SPOOLOURISO:CDLDURS:VDU31,29+P+6,10:IF S=1 PRINT*mg :CLSC IF S=2 PRINT*dbl*:ELSC PRINT*tbl* 600PROCwndo(P):CLS:PRINT:PS(P):PROCwoff(P)

600PROCHMO(P) CLS;PRINT;PS(P):PROCHOFF(P)
610NEXT
620P=NND(2)-1
630REPEAT
640P-1-P
650REDCH(13,0,29):PROCH(PNE(P)+" to throw",10,29,3)
660sc=PNdarts(H)
670N=PS(P)
680F0KT-0702
690IF PS(P):20 BOTO750
700IF PS(P):20 BOTO750
700IF PS(P):20 BOTO750
700IF PS(P):20 BOTO750
700IF S=2 AND H4(>*P" BOTO800
730IF S=2 AND H4(>*P" BOTO800
730IF S=1 AND(H="D" BF H="Y")BOTO800
740IF S=1 AND H4(>*P" BOTO800
750IF S=1 AND (H="D" BF H="Y")BOTO800
750IF S=1 AND (H="D" BF H="Y")BOTO800
750IF S=1 AND PS(P)=25 PS(P)=0
750IF S=*Y* AND PS(P)=5 PS(P)=0
750IF S=*Y* AND PS(P)=5 PS(P)=0
750IF PS(P)=21 PS(P)=25
BOONEXT
RIOTF PS(P)>N DR PS(P)=0 BCOLO,3:HOVE(29*P*6)*32.(20
SU(P):PS(P)=32:DRMA(31*P*6)*32-8,(21-SV(P))*32-4:PROCHOOLO
RECOUNTL PS(P)=0
RECOUNTL P

SZOUNTIL PS(P)=0 BXOPROCW(40,0,29):PROCM(PNS(P)=" won the match",3,29

(continued on page 153)

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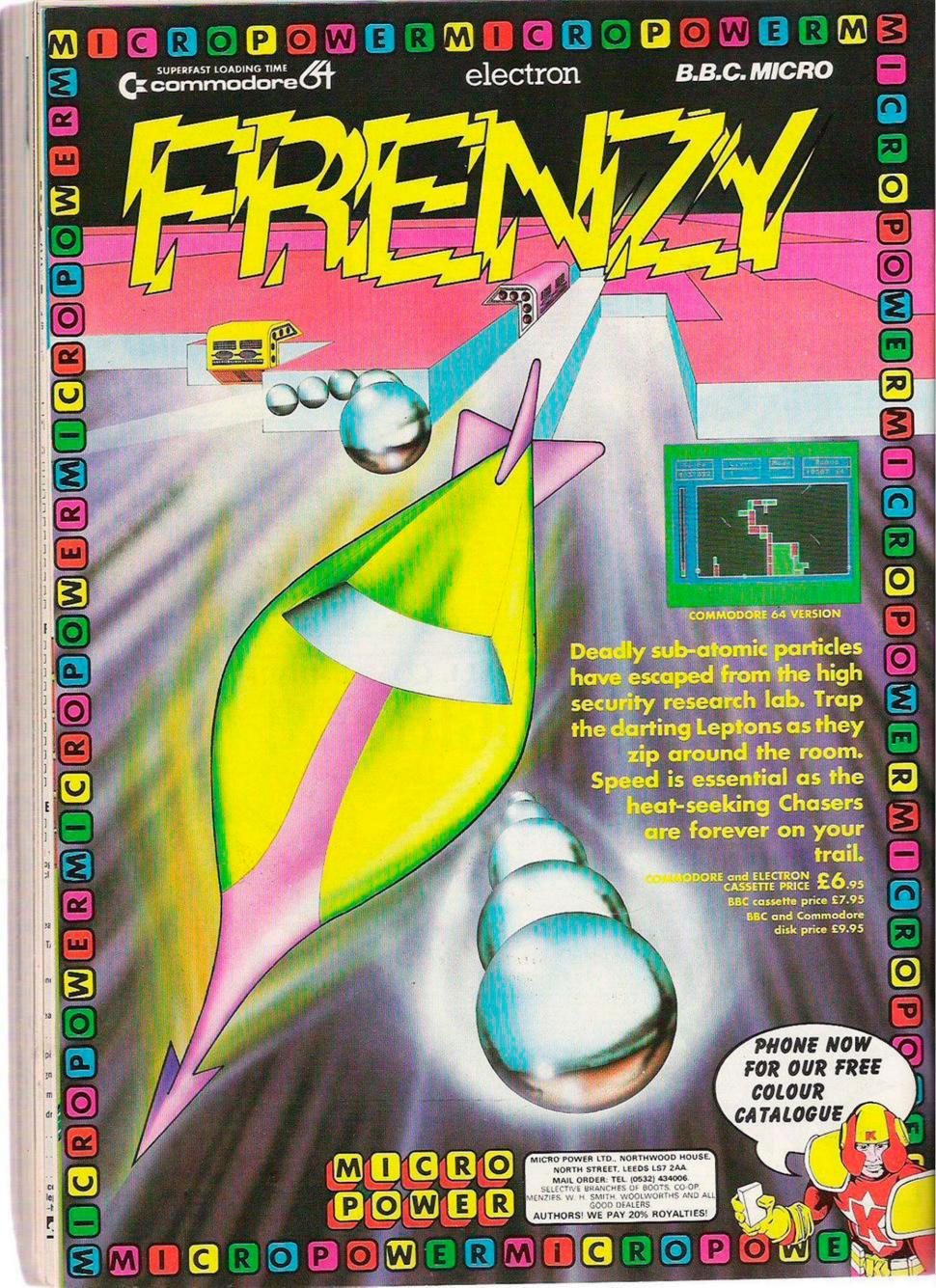
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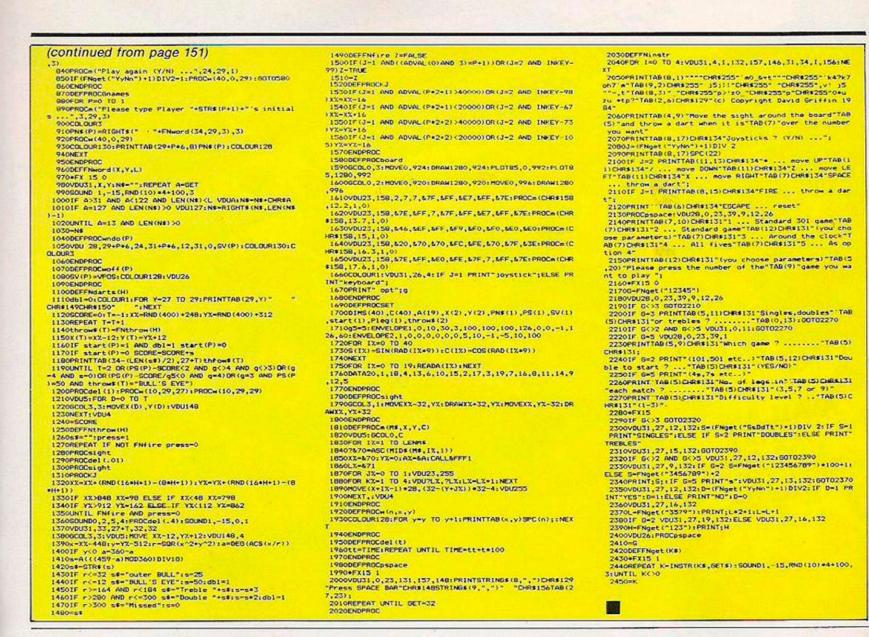
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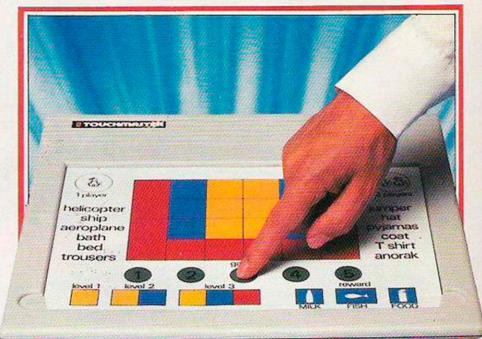
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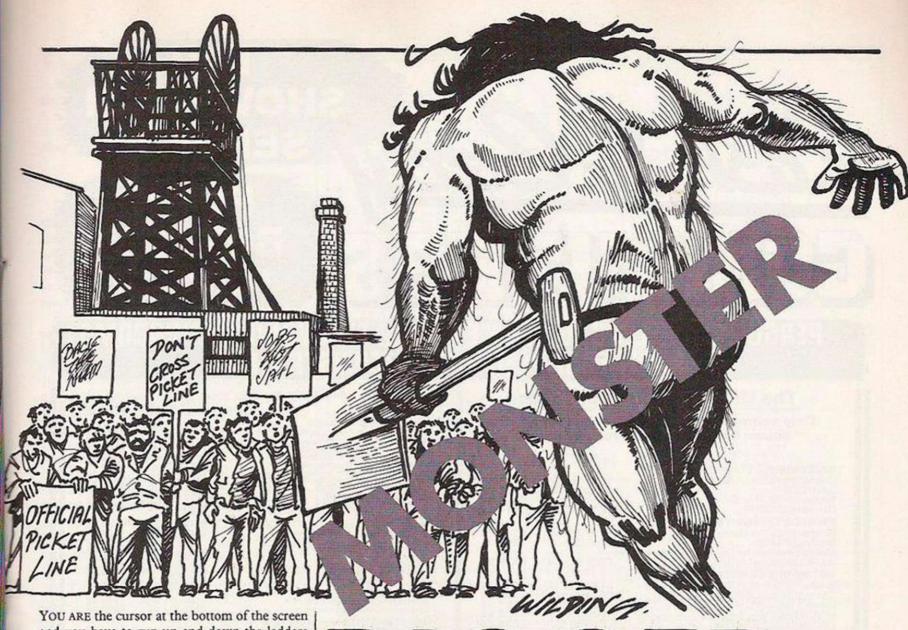
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YOU ARE the cursor at the bottom of the screen and you have to run up and down the ladders avoiding the mutants, digging holes and dropping the mutants through them before your oxygen runs out. You are given a fresh supply of oxygen each screen and the number of mutants gradually increases as the screens are completed to a maximum of eight. A full list of the keys used for movement is given in the Basic program before the game starts.

You can dig holes on any level except the bottom line and you are not allowed to dig two holes right by each other or dig next to a ladder. You cannot dig or fill while on a ladder as you will only move up or down it. To dig you press one of the down keys and a hole will appear next to your right or left depending on which way the cursor is pointing. Holes can be filled in using one of the up keys but will not work if there is a mutant in the hole.

To push a mutant through a hole move over it and jump using an up key. If you wait too long the mutant will start to flash showing you that it is about to pull itself up and mutate further into a stronger life form. There are three types of mutants of increasing strength — \$,\$ and inverse \$, points 50, 100, 200. A \$ and inverse \$ have to be dropped through 2/3 holes to kill them straight away and to obtain the full points or you can drop them through a lesser number of levels to weaken them but you do not get as many points. Also you can drop through the holes to escape the mutants.

The machine code is contained in a Rem statement in line 0 containing at least 2800 spare characters. The code is between addresses 16514 to 19314. To obtain a Rem statement of this size type:

1 REM 320 0s or any other single character (continued on page 157)

DIGGER

Michael Pike traps monsters in holes on his ZX-81 with 16K expansion.

```
Basic program.
                                    SEREM REPORT OF THE PARTY OF TH
                                                  PRINT
                                                                                                                                                       1,5;
                         15 PRINT
                                                                                                                  AT
8,2
                                                                                                                                                                                                                    HIGH SCORE R
  ESET
                                                                                   INKEY $ <>""
                        30
                                                                                                                                                                                                         THEN GOTO 30
                                                    LET A$=INKEY$
IF A$="" THEN_GOTO_35
                                                      IF A$ (>"Y"
                                                                                                                                                                         THEN GOTO 60
                                                                                                 16608,0
16609,0
                       50
                                                     POKE
                      55
                                                    POKE
                                                                                                L=USR 16778
                                                     STOP
             100
```

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EPSON FX100 F T (P)		
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(continued from page 155)

This is 10 full lines of zeroes exactly. Edit this and change it to line 2, edit this and change it to line 3 and so on until you have lines 1 to 9 in this way - each line having 320 characters. Now type:

POKE 16511,114 POKE 16512,11 POKE 16510,0

Do not return to the listing when typing these Pokes as this will cause a crash but type them one after the other until finished and then you can look at the listing. You should have one Rem-statement of 2816 characters including the Rem and Newline characters, more than enough to hold the code.

Enter the machine code in the hex dump using any hex loader, the start address is 16514 and the finish is 19314. Save this on tape a few times when finished. Now enter the Basic lines 10 to 100. Press Rand Newline as if you do not do this the mutants do not move randomly for some unknown reason and will probably refuse to fall into the holes, then Run. If the game crashes you have to type in a hex checker program and check all the code.

One more thing to note - never type in the line number of the line immediately after the Rem as this will cause line 0 to be listed again and again by the computer due to a bug in the Rom. Therefore type in line 10 of the Basic program before you erase the hex loader.

If you master the game too quickly there are two Pokes you can enter to make the game

Poking 18750 will cause the oxygen to

```
Hex loader.
   99
      REM HEX LOADER
              "START ADDRESS"
 100
      PRINT
              S
"FINISH ADDRESS"
 110
      INPUT
 120
      PRINT
 130
      INPUT
      FOR N=5
LET T=0
 140
                 TO F STEP 8
 150
 160
      PRINT
              N:
 170
       INPUT
              AS
              丹事;"
 180
      PRINT
 190
       INPUT
              TOT
              TOT
 200
      PRINT
           Z=0
      LET
 210
 220
      FOR K=1 TO LEN A$ STEP 2
LET C=(CODE A$(K)-28)*16+00
 230
      LET T=T+C
POKE N+Z,C
LET Z=Z+1
NEXT K
DE A$ (K+1) -28
 240 LET
 250
 260
 270
 280
       IF TOT=T THEN GO TO 310
 290 PRINT
              "ERROR - PLEASE INPUT
 AGAIN'
 300 GO TO
              150
  310 NEXT N
```

decrease at a different rate - it is presently set at 3. Poking with 0 will make the oxygen stay at 6000.

Poking 18899 will change the speed of the

game - this is initially set to 6.

The hex codes between 16608 and 16668 are data bytes and change during the running of the program and need not be 00.

```
- 140444776E50007444111
- 250446677444111
- 250446776E5007444111
- 250446776E500776
- 250446776E50076
- 250446776E50076
- 250446776E50076
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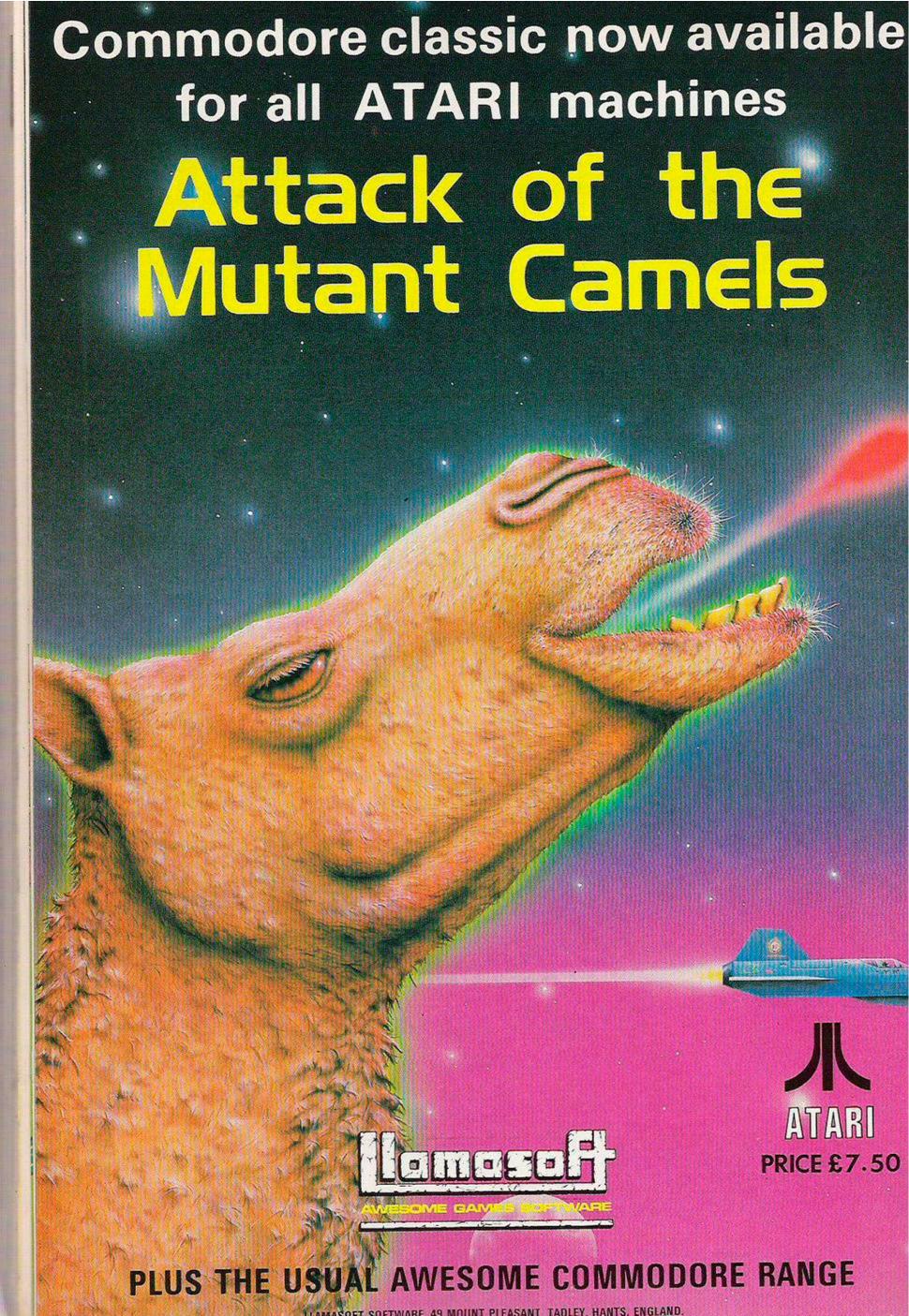
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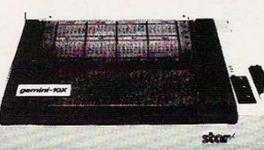
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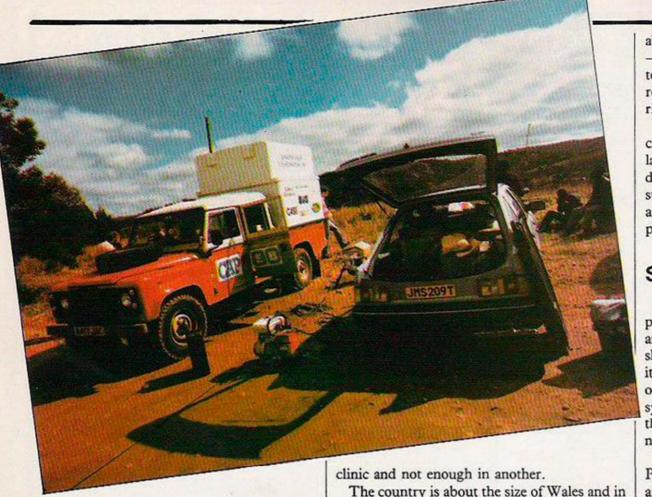


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SWAZILAND WAS HIT by a cyclone about six months ago. Floods destroyed many of the country's bridges and washed away sections of the rail network. Houses were levelled and the telephone system was widely disrupted. With foreign aid Swaziland has recovered but the incident emphasised the importance of management and communications in dealing with natural disasters.

It was difficult to know in the aftermath of the cyclone where equipment was situated, what the current stock levels were at remote clinics, how much stock had been damaged, how many people had been injured and the nature of their injuries.

Apart from disaster relief, Swaziland has many health care and agricultural problems. Tuberculosis is still a common disease. Organised attempts are being made to identify and treat people with TB using modern antituberculosis drugs such as Rifampicin.

Sent to the capital

If a case is suspected when someone is seen at a rural clinic or a district hospital they are sent to the capital for confirmation of the diagnosis. Treatment is started at the central hospital and the patient returns to the community. He or she will need a regular supply of Rifampicin for about two years.

It is in the nature of things that people move, complete their treatment, change their names, die from one or another cause and generally do all the things that complicate the lives of planners and managers.

On the one hand the Health Service administration aims to deliver supplies of the drug to the dispersed rural clinics so that nobody should have to walk more than five kilometres to collect their monthly supply. On the other, it is clearly important in any country, let alone Swaziland which is just emerging from being very poor, that expensive drugs like Rifampicin are not wasted because they are allowed to go out of date or because there is too much in one

The country is about the size of Wales and in computing terms I have heard it described as about equivalent to a medium-sized company such as Boots the Chemists. Systems analysis is

about defining the limits of one or more tasks

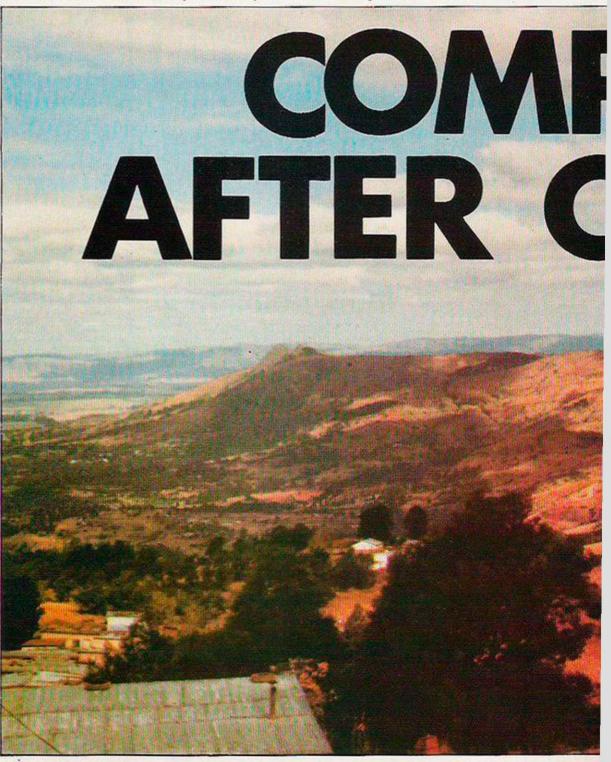
— a system — and then investigating the input
to the system, the manipulation of data that is
required and the outputs that will provide the
right answers at the right time for the users.

A stock control system might allow more efficient ordering and rotation of drugs. In Swaziland, nurses act as primary care workers, diagnosing and treating common illnesses, stitching wounds, carrying out vaccinations and child development surveillance, and dispensing medicines and contraceptives.

Supported by specialists

These skills can be supported by specialist physicians and surgeons working in district and central hospitals. In a country where skilled health care staff are few and far between it is arguable, for both disaster relief and ordinary health care, that communications systems may be a better investment, at least in the short term, than just trying to increase the numbers of doctors working in the country.

Alan Williams of Computer Analysts and Programmers U.K. Ltd (CAP) is a keen sailor and he had an idea that it should be possible to use maritime satellite communications techniques to improve communications between different parts of countries where the terrain



prohibits normal telephone or short wave radio links.

The links should be either internal to the country, joining remote sites to a focal point, probably in the capital; or external, joining sites in the country to remote databases and experts in other countries.

Additionally, a mobile satellite communications terminal could be driven to the site of a major disaster, or could be airlifted and dropped in to provide voice and data links so that supplies can be directed to the right place in the right quantities, reducing waste and increasing the rescue agencies speed of response.

Dol financed pilot study

The Department of Industry financed a pilot study into the feasibility of CAP's project. A Land Rover was equipped with a Saturn ship earth station — SES —, a 10 Megabyte hard disc computer with an ordinary dot matrix printer, a video camera and a digitiser to convert each picture into digital numbers that could be transmitted down a standard 75/1200 or 300/300 baud modem, and last, but wholly essential, a British Telecom telephone.

Mounted on the back of the Land Rover, the dish aerial and its mounting weighed enough

for the springs to require strengthening. The horizontal and vertical angles controlling the

for the springs to require strengthening. The horizontal and vertical angles controlling the direction in which the dish faces were set manually using a cheap dashboard-mounted compass and the final alignment was done

using the received signal strength readings from the satellite terminal. Bearings and azimuth readings were checked as Inmarsat dictates using a teleprinter terminal.

Inmarsat is an organisation that owns and operates a number of geostationary satellites used principally for marine navigation and communications. The satellites that we were using hang over the South Atlantic and Indian Oceans about 22,000 miles above the Earth's surface. The conditions under which Inmarsat operates permits the use of the satellites by land-based stations for humanitarian purposes.

Sharper than a ship

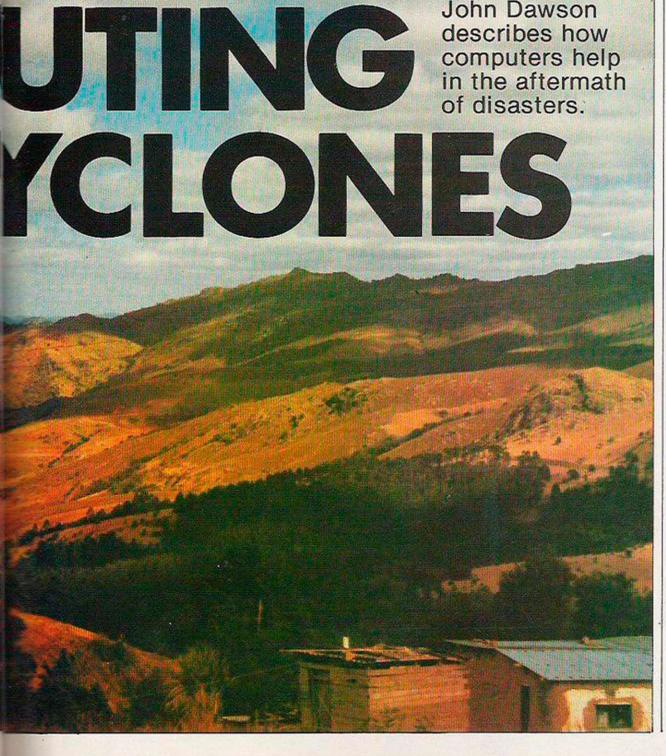
The motion of the Land Rover over rough surfaces is much sharper than a ship and the servo mechanisms holding the dish aerial on a steady bearing couldn't control the sudden accelerations. Power consumption in the test vehicle was probably higher than would be necessary in a production model.

CAP used a standard petrol-driven 230 volt 13 amp generator to run the satellite tracking electronics, the microcomputer and all the peripheral devices. Consequently, for both these reasons, the vehicle had to be stationary to receive or make calls.

Using the telephone we dialled through the satellite to one of the Packet Switch Stream — PSS — computers in the U.K. The PSS network is operated by British Telecom and provides a cheap and efficient method of exchanging information between computers.

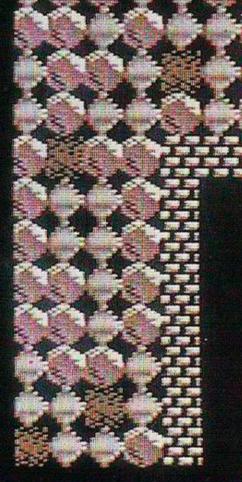
A number of computers are scattered around the United Kingdom in the main population centres such as London, Birmingham, Leeds, Cambridge and so on. You can obtain a Network User Identity or NUI from the Post Office and can then access the PAD — Packet Assembler/Disassembler.

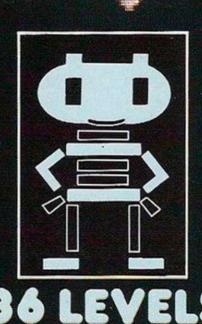
After entering your NUI you are asked for the address of the computer you wish to contact. The remote computer may be in the U.K. (continued on page 167)



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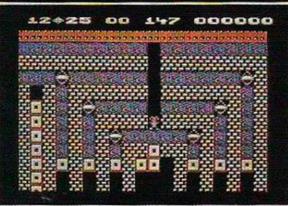




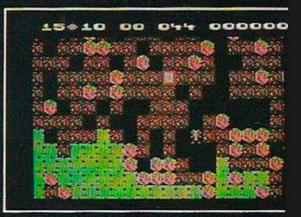


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Really Something &

(continued from page 165)

or it may be located just about anywhere else in the world. At first I was puzzled by a delay of about half a second before characters appeared on the computer screen but then I realised that it was simply the distance that was responsible — 22,000 miles up to the satellite, the same down to the Goonhilly earth station in Cornwall, to London, and then the return journey — about 88,000 miles in all, just under half a second at the speed of light in a vacuum.

From London it was easy to get into Data Mail in Switzerland and Colleague at Latham, close to New York. Information retrieval and communications in the Swazi uplands seemed to have been revolutionised overnight.

But was that really true? Certainly the equipment performed without fault despite the rough terrain over which it was carried. We learned that you need two channels open simultaneously for a sensible debate of medical problems, data can be exchanged on the first and the second must be a voice link so that the data can be discussed as it is presented.

Scope for development

Many ideas sprang out of the pilot study, for example there seems to be scope for the development of culture specific icons to help people with no previous training to use computers more easily. We give drugs according to the time of day in the United Kingdom but in a country where clocks are quite rare it makes very good sense to use pictures or ideograms of a rising sun, a midday sun, a setting sun and the moon to set the time at which doses must be given.

Conversely, I have thought for some time that selling inappropriate high technology to developing countries should be a serious crime. Nothing drains resources more quickly than the running costs and training requirements of a complex piece of high-tech equipment. While I have no doubt that computers and other equipment can benefit developing countries—that is only true provided they are used in the right way.

It's correct, for example, that a satellite communications terminal can cost less than a modest medical and nursing library and can give access to very large quantities of information. The Colleague searching software can track down material in a fraction of a second that a skilled human librarian might take hours to find. Keeping an electronic library up to date is comparatively easy and need not concern the remote user at all.

But the content of Northern hemisphere databases is aimed almost exclusively at Northern hemisphere users. That is not surprising for the object of a database owner is to collect together information that may be profit-

modest medical and nursing library and can

ably distributed.

Information that reflects the needs of doctors scientists and other professionals and technologists in the Northern hemisphere may well be wholly inappropriate for health care workers engineers, managers and agriculturalist working in developing Southern hemispher countries.

The information that I obtained from Col league's American textbooks of neurosurgery was interesting but not particularly relevant to the immediate needs that we encountered. The technological aspects of medicine, as opposed to medical science, are all important in isolated communities and developing countries.

We have more than enough knowledge to puright much of the world's ill health; what i lacking is the management and practical application of that knowledge. The construction of practical, technologically oriented databases offering relevant information seem to be one of the keys to the success of the information revolution in the third world.

The management and scientific problem facing Swaziland exist in varying degree throughout the developing countries. A straight transfer of developed country scienc and technology is likely to be an unsatisfactor; and superficial answer.

The sensitive development of relevant data bases and the application of the best and mos appropriate technology might allow Swaziland and other third world countries to escape som of the pitfalls we keep encountering.

Of course, the application of the same tech niques with the same management skill migh be expected to have a similar effect in other more developed countries as well.



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DIS/ASSEMBLER

Martin Lightfoot expands the programming potential of your CBM-64.

THIS PROGRAM is a complete machine-code programming tool for the Commodore 64. It contains a machine-code monitor which allows the easy manipulation of memory, a disassembler which translates machine-code programs into the more comprehensible assembley language format, and an editor/assembler which together allow assembly language programs to be developed and translated into machine code.

Monitor: Anybody who owns or used to own a Commodore Pet should recognise the style of this machine-code monitor as it is based on the TIM monitor which used to come as standard on the Pet but was dropped on the Vic-20 and CBM-64. It provides the user with the following seven commands:

M XXXX YYYY — displays on the screen the contents of memory between the given hex addresses.

F XXXX YYYY ZZ — fills memory between the given hex addresses with the hex byte 22.

T XXXX YYYY ZZZZ — moves memory between the hex addresses XXXX and YYYY to new address starting at ZZZZ.

G XXXX — executes a machine-code program starting at XXXX hex.

X — return to menu.

L or L"prog name" — loads previously saved machine-code program back into memory at address from where it was saved."

S"prog name" XXXX YYYY — saves memory between given hex addresses to tape.

Note — if no program name is required in the Save command, then the quotation marks must still be present, but left empty.

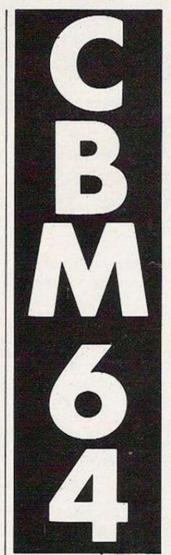
All numbers must be in hex and of the length shown. Spaces must be inserted between all hex numbers and command letters, except between the S or L command and the quotation marks. A space must be inserted after the second quotation mark in an S command before the start address of the save.

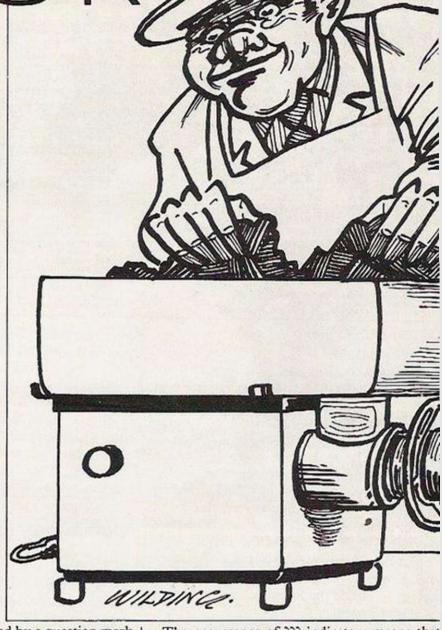
To edit the memory, just list the memory to the screen using the M command as previously described. Then move the cursor up to the required position on the screen and edit the data.

Note that all numbers must be in hex and two digits long, i.e., leading zeros may have to be added. When you have finished editing the memory pressing Return will Poke the new data into memory.

When displaying memory on screen using the M command, the Return key can be pressed to return to command mode.

All errors or mistakes in the syntax of





commands will be indicated by a question mark at the beginning of the offending line.

Disassembler: The disassembler, option three on the menu, is capable of providing assembly language translations of machine-code programs in memory in the standard format.

To use the disassembler, you are required to input a start address. This can be in either decimal or hexadecimal, in which case a dollar sign must precede the hex number.

Disassemble to printer

You are given the option of disassembling to the screen or printer. To disassemble to the printer, you must type Y to the question output to printer? To disassemble to the screen, you simply press Return.

After every 20 machine-code instructions disassembled, you have to press Space to disassemble the next 20 instructions, or any other key to return to the menu.

The disassembler can be used to plough through the 64's Rom or it can be used to disassemble code that you have already written. The occurrence of ??? indicators means that you are attempting to disassemble an area of memory that does not contain a machine-code program, or you have chosen a start address that is not the first byte of a machine-code instruction.

If the latter is the case, then the disassembler will eventually synchronise itself within the program in memory.

Editor: The editor is simply a means of entering your assembly language programs into the computer.

The editor works by changing the Basic pointers to point to a free area of memory, then you enter your assembly language program as you would a Basic program. This means you give each instruction a line number — only one instruction per line — and you insert and delete lines in the normal way. You can also Load and Save programs to tape or disc using the normal Basic commands. To get a listing of the program on printer use:

OPEN4,4:CMD4: LIST then after printing

(continued on next page)

```
10210 DATA RETURN.REM.STOP.ON.WAIT.LOAD.SAVE.VERIFY.DEF.POKE.PRINTW.PRINT.CONT
10215 DATA LIST.CLR.CMD.SYS.OPEN.CLOSE.GET.NEW.TABC.TO.FN.SPCC.THEN.NOT
10220 DATA STEP.+--**./-*.TAND.OR.).=.C.SSN, INT.ABS.USR.FRE.POS.SQR.RND.LOG.EXP
10220 DATA STEP.+--**./-*.TAND.OR.).=.C.SSN, INT.ABS.USR.FRE.POS.SQR.RND.LOG.EXP
10220 DATA STEP.*--**.TAND.ATN.PEEK.LEN.STR*.VAL.ASSC.CHR*.LEFT*.RIGHT*.NID*
10230 IFPEEK(736)=167THEN10400
10240 FORI=755T0761:READA:POKEI.A:NEXT
10250 DATA 83.89.83.55.49.48, 13
10260 FORI=256107025638:READA:POKEI.A:NEXT
10270 DATA 160,0.165.2.145.251.230.251.208.2.230.252.165.251.197
10280 DATA 253.208.240.165.252.197.254.208.23.4.165.2.145.253.96
10290 FORI=25639T025671:READA:POKEI.A:NEXT
10300 DATA 160,0.177.251.145,253.230.251.208.2.230.252.230.253.208.2
10310 DATA 230.254.165.251.205.52.3.208.233.165.252.205.53.3.208.226.96
10320 FORI=25672T025716:READA:POKEI.A:NEXT
10330 DATA 169.32.162.1.160.1.32.186.255.165.2.162.167.160.2.32.189.255.96
10330 DATA 32.72.100.166.253.164.254.169.251.32.216.255.96
10330 DATA 32.72.100.166.253.164.254.169.251.32.216.255.96
10335 DATA 32.72.100.169.0.162.255.160.255.32.213.255.96
10335 FORI=25717T025755:READA:POKEI.A:NEXT
10334 DATA 165.197.201.4.208.17.162.0.189.243.2.157.119.2.232.224.7.208
10355 DATA 165.197.201.4.208.17.162.0.189.243.2.157.119.2.232.224.7.208
10356 DATA 165.197.201.4.208.17.162.0.189.243.2.157.119.2.232.224.7.208
10358 DATA 165.197.201.4.208.17.162.0.189.243.2.157.119.2.232.224.7.208
10359 DATA 165.46.201.100.144.22.165.45.45.41.200.100.165.46.141.201.100
10380 DATA 165.46.201.100.144.22.165.45.45.41.200.100.165.46.141.201.100
10380 DATA 165.46.201.100.144.22.165.45.45.41.200.100.165.46.141.201.100
10380 DATA 165.46.201.100.144.22.165.45.45.41.200.100.165.46.141.201.100
10380 DATA 169.208.2142.166.76.174.167
10395 POKE25800.3:POKE25801.101:POKE25856.0:POKE25857.0:POKE25858.0
10396
  18285 DATA END, FOR, NEXT, DATA, INPUT#, INPUT, DIM, READ, LET, GOTO, RUN, IF, RESTORE, GOSUB
10400 REM *** ASSEMBLER ERROR MESSAGES ***

10410 ER$'(0)="ADDRESSING MODE
NOT AVMILABLE WITH THISMNEHONIC"

10410 ER$'(1)="INVMLID HEX NUMBER"

10420 ER$'(2)="OUT OF LABEL SPACE"

10430 ER$'(3)="LABEL NOT ALPHA-NUMERIC"

10440 ER$'(3)="NO SUCH HNEHONIC"

10450 ER$'(5)="SMANCH OUT OF RANGE"

10470 ER$'(7)="SINGLE BYTE OUT OF RANGE"

10470 ER$'(7)="SINGLE BYTE OUT OF RANGE"

10470 ER$'(7)="SINGLE BYTE OUT OF RANGE"

10480 ER$'(3)="NO SUCH THAN 6 CHRKS"

10480 ER$'(3)="NO SUCH THAN 6 CHRKS"

10470 ER$'(7)="SINGLE BYTE OUT OF RANGE"

10470 ER$'(7)="SINGLE BYTE OUT OF RANGE"

10470 ER$'(1)="NO BESEMBLY LANGUAGE PROGRAM"

10495 ER$'(1)="NO ASSEMBLY LANGUAGE PROGRAM"

10495 ER$'(1)="NO ASSEMBLY LANGUAGE PROGRAM"

10496 PR$'(1)="NO ASSEMBLY LANGUAGE PROGRAM"

10496 PR$'(1)="NO ASSEMBLE LANGUAGE PROGRAM"

10497 PRINT'ING" TERS (1)="NO ASSEMBLE CONTINUE"

10500 PRINT'ING" TAB (1)="NO ASSEMBLE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTINUE CONTI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              11050 A=LD/16:LD=LD-INT(A)#16
11060 HB=HS+MIDS(HTS,A+1,1)+MIDS(HTS,LO+1,1)
11070 RETURN
11090 :
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                12050 BY$=H$+" *
12060 IFNE(AM)=8THENBY$=BY$+"
12070 IFNE(AM)=2THEN12170
12080 H=PEEK(AD+1):00SUB11000
12090 BY$=BY$+H$+" *
12100 IFAM=10THEN12120
12110 00T012190
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    *:GOT012288
                                                                                                                                                                                                                                                                                                                                                                                                                                                                           11000 :'
11100 REM ### CONVERT HEX TO DECIMAL ###
11110 H=0:ER=0
11120 FORI=1TOLEN(H$):HH=FNDEC
(ASC(MIDS(H$,I,I))):H=H#16+HH
11130 IFHH>150RHH<0THENER=1
11140 NEXT
11150 IFHO65535THENER=1
11160 RETURN
1170:
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   12128 H1#PEEK(AD+1)
12138 IFH1(128THENH=AD+H1+2:GOT012158
12148 H=AD-(256-H1)+2
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          12130 IFHI(128THENH=ND+N1+2:00T012150
12140 H=ND-(256-H1)+2
12150 GOSUB11000
12160 OUT012190
12160 FL=1:H=PEEK(AD+1)+256#PEEK(AD+2):GOSUB11000:FL=0
12160 BY=BY+RIGHTS(H$,2)+" "+LEFT$(H$,2)
12190 BY=BY+RIGHTS(H$,2)+" "+LEFT$(H$,2)
12190 H="3"+H$
12200 ONNHOOT012590.12550.12500.12750
12200 ONNHOOT012590.12520.12500
12210 ON14-RHOOT012550.12500
12220 FL=1:H=ND :GOSUB11000:FL=0
12220 FL=1:H=ND :GOSUB11000:FL=0
12230 FRINT""H=NSPC(3)*BY** #*NB$
12240 IFFR=1THENFRINT#4.H#SPC(5)*BY** "MN$
12250 RD=RD+NB(RM)+1
12260 RFNT"*THENFRINT#4.H#SPC(5)*BY** "MN$
12250 RD=RD+NB(RM)+1
12260 FINT**THENESS # SPACE # TO CONTINUE
...":POKE190.0:FR=FRE(0)
12300 IFFN=OTHENESS # SPACE # TO CONTINUE
...":POKE190.0:FR=FRE(0)
12310 IFFL=UHENIZ000
12310 IFFL=UHENIZ000
12320 FEM=**PR***OCOSE4:GOT010500
                                                                                                                                                                                                                                                                                                                                                                                                                                                                         11000 REM ONE CONVERT DECIMAL TO HEX ORD
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                12490 :
12500 FEM *** ACCUMULATOR ***
12510 MNE=MMI* A"
12520 00T012220
                                                                                                                                                                                                                                                                                                                                                                                                                                                                              12020 MNS=MIDS(T3S,P1*3-2,3)
12030 AM=ASC(MIDS(T2S,PE+1,1))-47
12040 H=PE:GOSUB11000
        11018 HS-
11028 HI=INT(H/256):LOWH-HI@256:IFHI=@RNDFL=@THEN11050
11038 R=HI/16:HI=HI-INT(R)@16
11040 HS=HS+MID$(HT$,R+1,1)+MID$(HT$,HI+1,1)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              (listing continued on page 17.
```

(continued from previous page)

PRINT# 4:CLOSE4

When you have entered your program you simply press fl which, by using an interrupt, returns you to the menu by resetting the basic pointers to point to the assembler program which automatically Runs.

If, while typing in your assembly language program, you press Run/Stop and Restore simultaneously, the interrupt will be turned off, and pressing fl will not return you to the menu. If this is the case then you will have to type SYS700 to get back to the menu.

Make sure you type the Sys call correctly as the program could crash resulting in you having to switch the machine off and on again to regain control.

The editor gives you 6909 bytes to enter your assembly language programs which should be more than enough for most programs. If you find this limiting, you will have to type your programs in more than one part i.e., assemble one part, enter the next part using the editor, and assemble this second part directly after the first.

Two pass assembler

Assembler: The assembler incorporated in this program is a full two pass assembler, which allows the use of labels, variables and comments to make the assembly language program more understandable. It accepts all the standard assembler mnemonics in their standard formats.

The use of Labels enables a program to be directed to a named instruction without the need to calculate branches or jump addresses. For example, the instruction

BNE LABEL1

instructs the assembler to branch to the instruction with label name Label1. Elsewhere

in the program, there should be an instruction preceded with this label name. For example:

.LABEL1 LDA # \$FF

When a label is defined, it must be preceded with a full stop to tell the assembler that it is a label and not an instruction. The label can be any alpha-numeric characters - letters and numbers - and up to a maximum length of six characters. It should always be separated from the instruction with a space. There must be no space between the full stop and the label name.

Comments can be added

Variables can be defined as in a Basic program, for example:

LABEL1 = 49152LOOP1 = \$FFFF LABEL2 = LOOP1 - LABEL1 LOOP2 = LABEL1/256

The same rules apply to the variable name as those for the labels, except that no full stop is required. A total of 30 variables and labels are allowed in any one assembly language program. If you need more, then change the arrays SY\$ and SY in line 10005, and the 30 in line 20310.

Comments can be added to the end of an assembly language instruction by separating them with a semi-colon. Anything that appears after the semi-colon will be totally ignored during assembly.

The assembler also provides a simple expression evaluator for the addition, subtraction, multiplication and division of two numbers, labels or variables. For example:

LDA LABEL + 256 LOOP = LABEL/4096 STA CONST*10 TEMP = NEXT - FIRST SYMBOL = \$FFFF/256

The assembler provides six "directives" which do not appear in the machine-code program, but modify the manner of assem

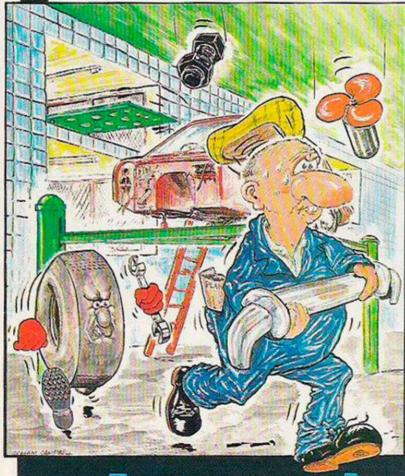
- ORG [address] this directive m appear at the beginning of every assen language program. It tells the assem where to place in memory the assemi machine-code program. More than ORG directive can appear in a sir assembly language program if diffe sections of the program are to be pla in entirely different areas of memory.
- PRT following this directive output the assembled program is diverted f the screen to the printer.
- SYM this indicates that the syr table containing all the values of varia and labels used in the assembly lange program, are to be appended to the lis of the assembled program.
- END when this directive encountered in a program, assemb terminated. It does not have to be the line in a program.
- BYT this directive allows a serie one byte values to be specified in a s line. The values will be entered dir into memory when the prograr assembled. Both decimal and numbers are allowed, but hex nun must be preceded by a dollar sign.
- TXT this directive allows a strip characters to be placed into memory characters must be enclosed v quotation marks after the TXT dire The ASCII values of each characte POKEd into memory.

The following areas of memory are avfor your machine-code programs.

DECIMAL (\$02A7) → 02FF) $679 \to 767$ 32768 → 40960 (8000 → A000) (6000 → D000) 49152 → 53248



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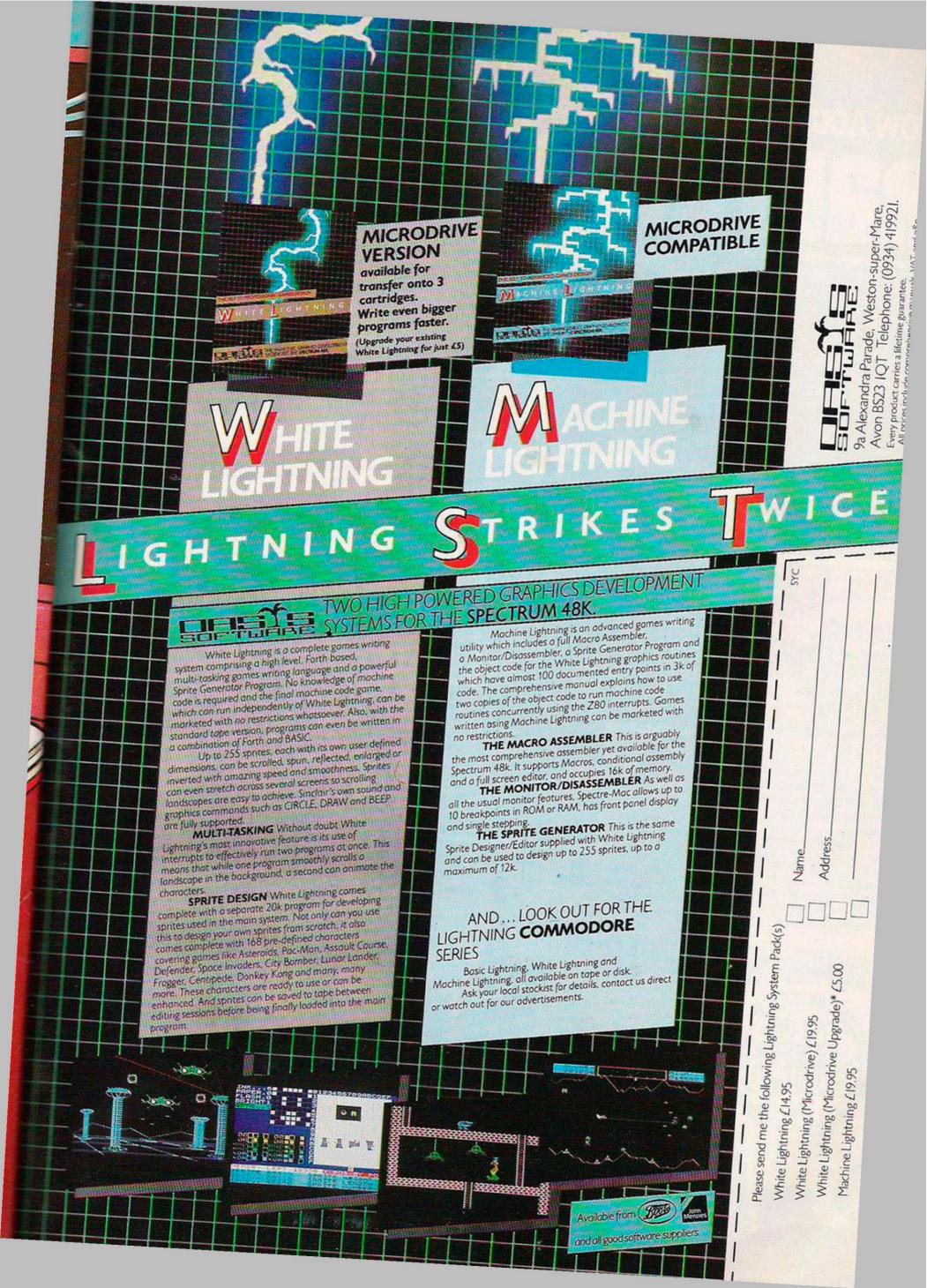
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```
(T2$,[,1))-47:F=F+1
22050 | FM=RMTHENOP=I-1:I=255:GOTO22070
22060 | FF=RSC(MID$(T4$,P1,1))THENI=235
22070 | MEXT
22090 | FDP=GRNDMN$()"EPX"THENER=0:GOTO23500
22090 | RETURN
22095
                                                                                                                                                                                                                                                                                                                                                                                                                                                                20045 MMS=LEFT#(OP#,3):GOSUB21500
20050 GOSUB21300:IFRM=GORRM=70RRM=8THENGOSUB22100
GOSUB21700
              (continued from page 170)
              12550 REM *** IMMEDIATE ***
12560 MH##MH** ***+H$
12570 GOTO12220
12600 REM *** ZERO FAGE/ABSG
12610 MH$#MH$** "*H$
12620 GOTO12220
12650 REM *** ZERO PAGE.X/AI
12660 MH##MH$** "*H$*",%"
12670 GOTO12220
12700 REM *** ZERO PAGE.X/AI
12710 MH##MH$** "*H$*",%"
12710 MH##MH$** "*H$*",%"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 20060 AD=AD+NB(AM)+1
20070 GOTO20010
          12550 RCM *** IMPEDIATE ***
12550 RCM *** IMPEDIATE ***
12578 GOTO12220
12600 REW *** ZERO PAGE/ABSOLUTE/RELATIVE ***
12610 MNS=MNS+" "+HS
12620 GOTO12230
12650 RCM *** ZERO PAGE.X/ABSOLUTE,X ***
12660 MNS=MNS+" "+HS+",X"
12670 RCM *** ZERO PAGE,Y/ABSOLUTE,Y ***
12710 MNS=MNS+" "+HS+",Y"
12720 RCM *** (INDIRECT,X) ***
12760 RCM *** (INDIRECT,X) ***
12760 MNS=MNS+" ("+HS+",Y"
12767 GOTO12220
12750 RCM *** (INDIRECT,X) ***
12800 RCM *** (INDIRECT),Y ***
12810 MNS=MNS+" ("+HS+"),Y"
12820 GOTO12220
12850 RCM *** (INDIRECT) ***
12850 MNS=MNS+" ("+HS+"),"
12870 GOTO12220
12850 RCM *** (INDIRECT) ***
12860 MNS=MNS+" ("+HS+")"
12870 GOTO12220
12890 SCM *** (INDIRECT) ***
12890 PCM *** MRCHINE CODE MONITOR ***
                                                                                                                                                                                                                                                                                                                                                                                                                                                                20070 GOTG20010
20080
20100 REM *** RDD VARIABLE TO SYMBOL TABLE ***
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              22095 :
22100 REM *** CONVERT OPERAND IN LABEL FORM OR
                                                                                                                                                                                                                                                                                                                                                                                                                                                                20110 GOSUB20300
20120 GOSUB21000:GOSUB22115
20130 SY(SY)=BY
20140 SY=SY+1:GOY020010
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       22100 REM *** CONVERT OPERAND IN LABEL FORM OR
HEX TO DECIMAL ***
22110 GOSUB21600:1F0Ps=""THENER=10:GOT023500
22115 GOT024000
22120 IFLEFT$(OP$.1)="$"THEN22150
22130 B*V=VAL(OP$.):IFSV=0RNDOP$C\"0"THENGOSUB21800
22140 IFSV\65535THENER=12:GOT023500
22145 RETURN
22150 H=*RIGHT$(OP$,LEN(OP$)-1):IFM$=""THENER=10:GOT023500
22155 GOSUB11100:IFER=ITHEN23500
22150 BY=H
22170 RETURN
22100 B*URH
22170 RETURN
22180 :
22200 REM *** REMOVE LABEL BEFORE PASS TWO ***
22210 G*LEN(OP$):FORI=1TOG
22220 IFLEFT$(OP$,1)C\" "THENOP$=RIGHT$(OP$,
LEN(OP$)-1):GOT022240
22230 I=O
                                                                                                                                                                                                                                                                                                                                                                                                                                                     20120 GUSUBZEZERS
20130 SY(SY)=87
20140 SY(SY)=87
20140 SY(SY)=87
20140 SY(SY)=87
20140 SY(SY)=87
20150 SY(SY)=87
20240 REM *** ADD SYMBOLIC ADDRESS TO SYMBOL TRBLE ***
20210 OP$=RIGHT$(OP$,LEN(OP$)=1)
20220 SY(SY)=8D:SY=SY+1
20230 FETURN
20230
20230 FETURN
20230
20230 FETURN
20230 FOR1=170LEN(OP$)
20230 FER *** REMOVE LABEL NAME ***
20310 IFSY>30THENER=2-GOT023500
20230 FOR1=170LEN(OP$)
20230 FIRS*= "ORR*=**-THENI=LEN(OP$):GOT029370
20330 H=MIDS*(OP$).1:1
20340 IFS*= "ORR*=**-THENI=LEN(OP$):GOT029370
20350 IFS*=(***)
20350 IFS*=(***)
20350 SY(SY)=SY*(SY)+AF
20375 IFLEN(SY*(SY)+AF
20375 IFLEN(SY*(SY)+AF
20375 IFLEN(SY*(SY)+AF
20375 IFLEN(SY*(SY)+AF
20370 MEXT
20440 NEXT
20440 NEXT
20440 IFFR=1THENER**:GOT023500
20440 SY=RIGHT$(OP$,LEN(OP$)=LEN(SY*(SY)))
20430 RETURN
20440
20530 RETURN
20530 PEM *** DEAL NITH ORG DIRECTIVE ***
20510 OP$=FIGHT$(OP$,LEN(OP$)=3):GOSUB21000
20530 PEM *** DEAL NITH ORG DIRECTIVE ***
20510 OP$=FIGHT$(OP$,LEN(OP$)=3):GOSUB21000
20530 PEM *** DEAL NITH ORG DIRECTIVE ***
20510 OP$=FIGHT$(OP$,LEN(OP$)=3):GOSUB21000
20530 COSUB22115
20530 COSUB22115
20530 COSUB22115
20530 OSUB22115
20530 OSUB22115
20530 OSUB2115
20530 OSUB2115
20530 OSUB2115
20530 OSUB2115
20530 OSUB2115
20530 OSUB21150
20540 OSUB
          12878 GOTO12228
12980:
12989 REM ### MRCHINE CODE MONITOR ###
13808 PRINT";
13808 PRINT";
13818 FR=FRE(8):PRINT"#": INPUT#1.CO$
13828 IFCO$=""THEN13818
13828 IFCS*="THEN13808
13838 IFC$="THEN13808
13838 IFC$="M"THEN12288
13868 IFC$="M"THEN12388
13868 IFC$=""THEN13408
13878 IFC$=""THEN13408
13878 IFC$=""THEN13788
13888 IFC$="G"THEN13808
13188 IFC$="G"THEN13808
13189 IFC$="G"THEN13808
13189 IFC$="G"THEN13808
13189 IFC$="G"THEN13808
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           22230 I=0
22240 NEXT
22250 GOSUB21000
22260 RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          22268 RETURN.
22270:
22308 REM ### RELATIVE ADDRESSING ROUTINE ###
22310 GOSUB22100
22320 OS=RD+2-BY
22330 IFOS)1280ROS<-127THENER*6:GOTO23500
22340 IFSON(OS)*1THENOS*256-OS
22350 BY=ABS(OS):00T023150
22360 IFOS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       13168 :
13199 REM *** DISPLRY MEMORY ON SCREEN ***
13298 IFLENCOS>C11THEN13150
13218 CD=*RIGHT**(COS,4)
13228 HS=LEFT**(COS,4):60SUB11186:IFER=1THEN13158
13248 HS=RIGHT**(COS,4):60SUB11188:IFER=1THEN13158
13248 HS=RIGHT**(COS,4):60SUB11188:IFER=1THEN13158
13258 HZ=H
13258 HZ=H
                                                                                                                                                                                                                                                                                                                                                                                                                                                        13240 H*=RIGHT*(CO$,4):GOSUBI1100:IFER=ITHEN13150
13250 RZ*H
13260 IFR2(A1THEN13150
13270 PRINT:PRINT:FORI=A1TOR2STEP8
13270 PRINT:PRINT:FORI=A1TOR2STEP8
13280 H=PEEK(1+J):GOSUBI1000:FL*8:PRINT"", "H$", "J=0
13290 H=PEEK(1+J):GOSUBI1000:PRINT" "H$;
13295 GETIMS:FIFNS=CMR*(12)THENJ=7:I=A2
13300 J**J*1:IFJC8THEN13290
13305 FR=FRE(0)
13310 PRINT:NEXT
13320 GOTO13010
          13339 : 13399 REH ### HEMORY HODIFY ROUTINE ### 
13400 IFLEN(CO$)
13410 H$=HID$(CO$,2,4):GOSUB11100:IFER=1THEN13150 
13420 AD=H 
13430 FORI=6T027STEP3:IFHID$(CO$,I,1)
"THENER=1:I=27 
13440 HEXT
               13336
20770 [FFHE] THENHUMHUHUHUH]: RETURN
20777 FEM *** PRSS TWO 'BYT' ***
20775 FEM *** PRSS TWO 'BYT' ***
20776 FL=1 H=AD: 003UB11000 : AD#=H#: FL=0: GOSUB23400
20790 R=MIDD**(OP$, J, I)
20800 IFRS=", "THEN20830
20810 NEM**
20820 NEXT
20830 IFLEFT$(N#, 1)="#"THEN20860
20840 H=VAL(N#) IFN225STHENER*12: GOTO23500
20845 IFH=60HUMEC>"0"THENER*10: GOTO23500
20850 GOTO20880
20850 H=RIGHT$(N#, LEN(N#)-1): GOSUB11100: IFER=1THEN23500
20870 IFN2SSTHENER*12: GOTO23500
20870 IFN2SSTHENER*12: GOTO23500
20880 POKERD, H: AD=AD+1: N#="":IFJ=LEN(OP#)+1THENPETURN
20890 NEXT
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       23210 H=D1:GOSUB11000:BY$=BY$+H$:POKEAD+2.D1
23220 GOSUB23400
23230 AD=AD+NB(AM)+1
23240 GOTU23810
23250 :
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       23409 RM WWW OUTPUT ASSEMBLED PROGRAM WAR
23410 PRINTW4, ADS" "; BYS" "LN; CS
23420 RETURN
23430 :
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          23500 REM *** OUTPUT ERROR MESSAGES ***
23505 IFERO11ANDPA=2ANDLEFT*(C*,3)<"BYT"
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    23500 REM ### OUTPUT ERROR MESSAGES ###
23505 IFERC11ANDPR=2ANDLEFT$(C$,3)C"BYT"
THENPRINTTAB(13)LN;C$
23506 IFER=1ANDHO65535THENER=12
23510 PRINT*##F:PRINT**PER$(E$)," EKROR",
23515 IFERC11THENPRINT* IN*;LN;
23517 PRINT
23520 PRINT*RESEMBLY TERMINRTED**
23530 PRINT*PRESS SPACE**POKE198.0
23540 GETINS:IFIN$C)** "THEN23540
23550 PRINT*D**:RUN
23560 :
23560 REM ### ASSEMBLY COMPLETE ###
23610 IFLT=1THENGOSUB23700
23620 CLOSE4
23630 PRINT*D**SEMBLY COMPLETE**
23640 GOTO23530
23650 :
23708 REM ### OUTPUT SYMBOL TRBLE ###
23707 IFSY**ITHEN23750
23710 FORI=*ITOS**-I*H*SY(I):GOSUB11800:SY$**SY$*(I)*LEFT$*
("" S*-LEN(SY$*(I)*)
23720 PRINT#4, SY$*,H$
23730 PRINT#4,SY$*,H$
23730 PRINT#4,SY$*,H$
23730 PRINT#4,SY$*,H$
23730 PRINT#4,*TOTAL NUMBER OF SYMBOLS -";SY=1
23760 RETURN
23770 :
23800 REM ### REMOVE COMMENTS FROM ASSEMBLY
                                                                                                                                                                                                                                                                                                                                                                                                                                                     20880 POKERD.H.AD=AD+1.NE="'IFJ=LEN(OP#)+ITHENPETURN
20890 NEXT
20990 REXT
21000 REW *** PEMOVE LEADING SPRCES ***
21010 G=LEN(OP#):FORI=ITOG
21020 R#*LEFT*(OP#,I):IFR*=" "OKA**"="THENOP*=RIGHT*
(OP#,LEN(OP#)-I):GOTO21040
21030 I=G
21040 NEXT
21050 RETURN
21050 RETURN
21060
21130 NexT
21110 SR*NNA
21120 LN=PEEK(SA*2)+256#PEEK(SA*3)
21130 NexPEEK(SA*2+256#PEEK(SA*3)
21130 NexPEEK(SA*2-2+256#PEEK(SA*3)
21140 OP*=""'V**" SCOP:SM***
21150 FORI=SA*4TONA-2-A=PEEK(I)
21160 IFR=34THENSM*I-SM**GOTO21180
21161 IFR=34THENSM*I-SM**GOTO21180
21161 IFR=34THENSM**I-SM**GOTO21180
21162 IFR=176ATHENSM**I-SM**GOTO21180
21163 OP*=OP**CHR**(A)
21170 IFR:IOH**COP**I-ID***THENOP**LEFT*(OP*,
LENCOP**)-I):GOTO21230
21200 IFR:IOH**COP**I-ID***THENOP**LEFT*(OP*,
LENCOP**)-I):GOTO21230
21200 IFR:IOH**COP**I-ID***THENOP**LEFT*(OP*,
LENCOP**)-I):GOTO21230
21300 REM **** IDENTIFY ADDRESSING MODE ****
21310 IFNM**OP**THENOM**9 RETURN
       13650 SVS(25629):GOT013010
13670 PEM *** LORD MEMORY FROM TAPE ***
13710 NAME=""!FCOS="L"(HEM197200
13720 GOQUD13300 FEREIDHEN13750
13730 POKEZ,LEN(NAS):SVS(25704)
13740 H=PEEK(829)-SSS=PEEK(830) GOSUB11000 SAS=HS
13750 H=MPEEK(829)-SSS=PEEK(832)-GOSUB11000 ERT=HS
13750 PRINT PRINT CODE LOCHTED AT "SAS" TO "EAS
           13778 GOTO19818
       13780
13800 REN *** SAVE MEMORY TO 166E ***
13810 NASE** GOSUB12000 (FERE) [HEN] 150
13820 CO1=RIGHTS COS.LEN (O) - LEN (NI) - 1
13830 (FLEN(O) - 10 (MENTS)50
13830 (FLEN(O) - 10 (MENTS)50
13830 SAWH HISF(OS 2, 4, GOSUB11100 (FER=) (HEN) 150
13830 SAWH HISF(OS 3, 4, GOSUB11100 (FER=) (HEN) 150
13830 ENH HISF(OS 5, 4, GOSUB11100 (FER=) (HEN) 150
13830 ENH FERC=SATHEN13150
13830 POKE252, SA 256 POKE251, SA 256 PEEX (252)
13830 POKE254, EA 256 POKE253, EA 256 PEEX (254)
13830 POKE254, EA (256) POKE253, EA 256 PEEX (254)
13830
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          23770 :
23800 REM *** REMOVE COMMENTS FROM ASSEMBLY
                                                                                                                                                                                                                                                                                                                                                                                                                                                       21240 RETURN
21250
21300 REM *** IDENTIFY ADDRESSING MODE ***
21310 IFMN#=OP$THENAM=9:RETURN'
21313 XHE:YHB:OP$=RIGHT$(OP$,LEN(OP$)=3):GOSUB21808
21320 REFEICHT$(OP$,LE) IFLEFT$(MH$,1)="B"ANDA$()
11320 IFOP$="A"THENAM=10:PETURN
21340 IFCFT$(OP$,1)<"("THENAM=10:PETURN
21340 IFCFT$(OP$,1)<"("THENAM=11:X=1:Y=3:RETURN
21340 IFRIGHT$(OP$,3)=".X"THENAM=11:X=1:Y=3:RETURN
21350 IFRIGHT$(OP$,3)=".X"THENAM=12:X=1:Y=3:RETURN
21360 IFRIGHT$(OP$,3)="):THENAM=12:X=1:Y=3:RETURN
21370 IFRIGHT$(OP$,1)=""THENAM=0:GOTO23500
21370 IFRH=13THENETURN
21380 ER=10:GUTO23500
21390 IFLEFT$(OP$,1)=""THENAM=2:X=1:Y=0:PETURN
21400 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21410 IFRIGHT$(OP$,2)=",X"THENAM=7:X=0:Y=2:RETURN
21420 H=16:PETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       23800 REM ### REMOVE COMMENTS FROM ASSEMBLY
PROGRAM LINE ###

23818 AF="":FORI=ITOLEN(OP$)
23820 IFMID$(OP$,1,1)=";"THENI=LEN(OP$):QOTO23840
23820 REMER*MID$(OP$,1,1)
23840 NEXT
23850 OP$=A$:RETURN
23850:
24800 REM ### CHECK IF OPERAND CONTAINS +-#/ ###
24810 CO#0:FORI=ITOLEN(OP$):R=RSC(MID$(OP$,1,1))
24920 IFA=430RR=450RR=47THENCO=CO+1:
IFCOE:ITHENFL=1
        13995
13999 REM *** GET FILE NAME FROM COS ***
13900 IFMIDS(COS.2.1) C)CHR$(34.THENER=1 PETURN
13910 COS=RIGHT$(COS.LEN(COS)-2.FL=0
13920 REM:FORNEITOLEN(COS)
13930 IFMID$(COS,I.1)=CHR$(34)THENI=LEN(COS):ER=0:GOTO13950
13940 NAS=NRS+MID$(COS,I.1)
13950 NEXT:IFFL=ITHENRETURN
13960 IFLEN(NRS))I6THENER*
13960 IFLEN(NRS))I6THENER*
13965 IFER=10PNAS="THENRETURN
13970 PORT=ITOLEN(NAS):POKE678+I.ASC(MID$(NAS,I.1)) NEXT
13980 RETURN
13990
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        21420 HPEGORECOPS, 27 ** , Y THERMONS , NO Y=2 ** , 21420 HPEGORECOPS , NO Y=2 ** , 21420 HPEGORECOPS , NO Y=2 ** , 21540 PEGORECOPS , NO Y=2 ** , 21540 PE
                                               REM ### EXECUTE MACHINE CODE PROUPAM ###
IFLEN(COD) > OFTHEN(3150
H#=RIGHTS(COD; 4) GOSUB11100: IFER=1THEN13150
SYS(H): GOT013010
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       :GOSUB21000
24150 COSUB2120
24150 HC=8Y
24170 IFS#="+"THEN24300
24180 IFS#="-"THEN24460
24190 IFS#="-"THEN24460
24190 IFS#="+"THEN24500
24200 IFS#="#THEN24500
24210 STOP
24300 REM ### ADD EXPRESSION ***
24310 SY=81+82
24320 IFRY>65535THENER=12:GOT023500
24340 PETURN
24340
                                                                                                                                                                                                                                                                                                                                                                                                                                                          21600 REM *** REMOVE SRACKETS ETC ***
21610 OPS#LEFT$(OP$.LEN(OP$)-Y)
21620 OPS#RIGHT$(OP$.LEN(OP$)-X)
21620 X=0 Y=0 RETURN
                                               REM *** PROGRAM EDITOR ***
PRINT"DEDITOR# - "F1" TO RETURN TO MENU*
POKE43.1: POKE44,101
POKE45.0: POKE56.128
CLR
PRINT"M"FRE(0)"BYTES FREE": SYS(25743)
END
                                                                                                                                                                                                                                                                                                                                                                                                                                                          15000 : 15000 : 20000 RIM *** PERFORM PASS ONE RSSEMBLY ***
20000 PRINT*IPASS ONE ASSEMBLY** : SY=1:AD=0:PA=1
20010 FR=FRE(0):GOSUB21100
20012 IFPEEX(25800)*256*PEEX(25801)*25659THENER*11:GOTO23500
20015 IFN=0*THEN22000
20015 PRINTLN:C$:SY*0:IFOP$="*THEN20010
20017 IFAD>65535THENER*12:00**0723500
20016 PRINTLN:C$:SY*0:IFOP$="*THEN20010
20019 IFOP$="*SYM*IHEN20010
20019 IFOP$="RT*ITHEN20010
20019 IFOP$="RT*ITHEN20010
20020 IFLEFT$(OP$,1)="."ANDLEN(OP$)>1THENGOSUB20200
20022 IFLEFT$(OP$,3)="ANDLEN(OP$)>1THENGOSUB20200
20035 IFLEFT$(OP$,3)="*THENGOSUB2000:GOTO20010
20035 IFLEFT$(OP$,3)="BYT*THENGOSUB20700:GOTO20010
20040 IFVA=ITHEN20100
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        24339 PETUNN
24340 PETUNN
24400 REM *** SUBTRACT EXPRESSION ***
24410 BV=R1-R2
24420 IFBY(OTHENER=12:00T023500
24430 RETURN
24440
24540 RETURN
24540 IFR2=OTNEHER=13:00T023500
24520 BV=INTVAL/R2>
24520 BV=INTVAL/R2>
24520 RETURN
24540 IFRY
24640 PEM *** MULTIPLY EXPRESSION ***
24610 BV=R14R2
24620 IFBY/65535THENER*12:00T023500
24630 RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                          21738 - RETURN 21738 - RETURN 21738 - RETURN 21810 EPH ### CHECK VALID LABEL ### 21810 EPH FORI=170SY 21820 Hopes-Sys() Themes-0 Ey-Sy(I) law 21820 Hopes-Sys() Themes-0 Ey-Sy(I) law 21820 Hopes-Sys() Themes-22768 RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                          21030 IEST
21835 IFER=1RNDPA=1THENEV=32768: RETURN
21840 IFER=1THENER=5-00T023590
21850 RETURN
                                                                                                                                                                                                                                                                                                                                                                                                                                                             22000 FEH *** FIND OPCODE FOR MEMONIC ***
                                                                                                                                                                                                                                                                                                                                                                                                                                                           22010 F1=(1+2)/3 Hmg Fmg:(Pmg
22020 IFRSC(MID#(T4#,P1,1))=1THENOP=ASC(MID#(T5#,P1,1))
                                                                                                                                                                                                                                                                                                                                                                                                                                                             RETURN
22030 FORIHASC(MID#(T5#,P1,1))+1T025SSTEP4
22040 IFASC(MID#(T1#,I,1))+P1+34THENNHASC(MID#
```







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The example shown here is a print spooler, you can use it to print a file while continuing to use the machine for development.

As well as executing faster than programs written in Basic, machine-code programs are usually smaller. Although this may not seem so important on a machine with over 90K bytes of user memory, remember that the smaller a program is, the faster it loads. Another reason that machine-code programs load faster is that Basic programs require considerable checking and pre-processing during loading.

QDOS provides many system calls that allow the machine-code programmer access to most of the facilities available from Basic as well as many that cannot be used from Basic at all. So that the calls do not change every time a new version of the QL Rom is made, they are all accessed either through traps or via vectors:

Traps use the 68000 Trap instructions.

There are 16 of these instructions written

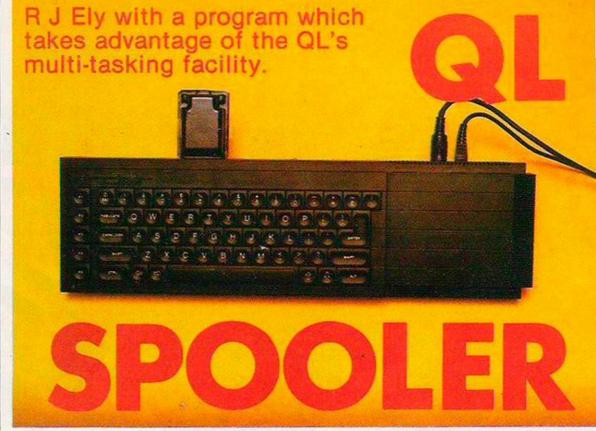
TRAP # 0, TRAP # 1, ... TRAP # 15

Each trap instruction causes a call to the trap routine whose address is contained in the trap vector. The trap vectors occupy addresses 128 to 191 in the Rom, each vector contains a 32 bit pointer to the corresponding trap routine. The trap routines are similar to subroutines except that the status register is pushed as well as the program counter when they are called.

They return using the RTE instruction instead of the RTS instruction. QDOS uses traps 0 to 3 for system calls; the caller uses register DO to specify which function is requested while additional information is provided in other registers. Most I/O is performed using these trap routines.

System routines that need not be executed in supervisor mode may be called using their vectors in the low part of Rom. Each of these vectors contains the 16 bit address of the subroutine in question — all of these routines are in the first 32K bytes of memory. For instance, the vector for the "print error message" routine is CC hex — or \$CC — so to call this routine the following sequence may be used:

MOVEA.W @W# \$CC,A2 read vector from address \$CC into A2 JSR (A2) call the subroutine that A2 points to The @L# prefix is the syntax for absolute



word addressing in the assembler used in this example. In some assemblers absolute addressing is assumed if you specify an absolute origin using the Org directive. As Sinclair undertakes not to change the positions of these vectors, it doesn't matter if the actual addresses of the vectored subroutines are different for different versions of the QL Rom.

Machine-code programs for the QL are loaded and run using the Exec command — see QL manual, keywords. Such programs should be position independent or should, when loaded, relocate any part of themselves that is not. This isn't as bad as it sounds since the 68000 was designed to make position independent code easy to write and quick to execute.

The idea is that you assemble your code — preferably using an assembler — in any area of memory that you have reserved for the purpose. The code is then saved in a Microdrive file using the Sexec command — QL manual, keywords — and can be run using the Exec command. QDOS assumes that the program starts at the first byte of the file. It is a convention — which you may ignore — that bytes 8 to n+9 of the code contain the ASCII program name preceded by n, the number of characters in the name.

To reserve an area of memory from Basic you should use the RESPR command — this is not in the QL manual but

not in the QL manual but you can see an example in one of the Boot programs on the bundled software cassettes

— for example, a = RESPR(1024) will reserve 1024 bytes and return the address of the reserved area in a. Memory thus reserved

is only freed when the machine is re-booted

When a machine-code program, often called job in the documentation, is run using the Ex command, the program is entered with a pointing to the start of the job. A4 holds a offset to the job's data area and A5 is an offset to the top of the stack. Two zero words will a on the top of the stack.

The print spooler in the example go through the following steps:

Prompt the user for the name of the file be spooled and read the reply from the console. If they type * exit from the job

■ Try to open the file specified, if the open fails, print an error message and return step 1.

As no further dialogue is required, clos the console channel and release Basic s that the user may continue with other tasks.

Read a line from the file, if it is the end of the file exit from the job — after closing the file and the print channel of course.

the file and the print channel of course.
Print the line on the printer and loop to Note that all this could be done using the Copy_N command, the difference is that you

would then have to wait for the printing I finish before you could use the computer for anything else.

If your printer has auto line feed, you shou omit lines 104 and 105.

This listing was prepared using our ow assembler. It is available for £20 (inc. post an packing) from: QCODE, 42 Swinburne Road Abingdon, Oxon.

If you have one of the other assembles currently available for the QL, you shoul make the following alterations to listing 1:

Replace "=" in lines 33 to 41 with "EQU

Omit the prefix "@W=" in line 76

■ User underscore instead of "." in QDO symbols such as IO.OPEN

If you don't have an assembler, listing provides a Basic program to create the spoole shown above. When you run this program, will generate the code in memory and save it t "mdvl_spooler_code". You should have cassette in mdvl of course. The @W # prefix not mandatory in the latest version (1.04) of th QCode assembler.

(listings on page 179)



All for the 48K Spectrum.

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```
$10(A4).A1
                                                                                    60 0032 43EC
                                                                                                           LEA
                                                                                                                                          address to store input
Listing 1.
                                                                                            0010
                                                                                    61 0036 4E43
                                                                                                           TRAP
 1 0000
                      SPOOLER
                                   copyright (c) 1984 R.J.ELY
                                                                                                                   #" .* . $10(A4)
                                                                                                                                          just exit if they type #
                                                                                    62 0038 OC2C
                                                                                                           CHPI.B
 2 0000
                                                                                            002A
 3 0000
                       To invoke the spooler type:-
                                                                                            0010
                      EXEC_W MOV1_SPOOLER_CODE
 4 0000
                                                                                    63 003E 6700
                                                                                                           BEQ.L
                                                                                                                   EXIT1
 5 0000
                      the spooler will then run and prompt for a file name
                                                                                            007E
 6 0000
                      Enter the filename, eg
                                                                                    64 0042 5341
                                                                                                           SUBQ
                                                                                                                   #1.D1
                                                                                                                                          dont count (1f)
 7 0000
                      FILE>ndv1 spooler list
                                                                                                                                          length of input string
                                                                                    65 0044 3941
                                                                                                           HOVE
                                                                                                                   D1. $E(A4)
                       if the file cannot be found SPBOLER will prompt again.
 8 0000
                                                                                            000E
                       When a valid filename is entered SPOOLER will release
 9 0000
                                                                                    66 0048
                       the BASIC interpreter to continue with other work, and
10 0000
                                                                                    67 0048 7001
                                                                                                           HOVER
                                                                                                                   #10.OPEN, BO
                                                                                                                                          set up to open input file
11 0000
                      continue to list the specified file to the device
                                                                                    68 004A 72FF
                                                                                                           MOVEO
                      specified at OUTFILE (eg a printer).
                                                                                                                   #-1.D1
12 0000
                                                                                                           HOVER
                                                                                    69 004C 7601
                                                                                                                   #1.03
                                                                                                                                          old (shared) file
13 0000
                                                                                    70 004E 41EC
                                                                                                                   $E(A4),A0
14 0000
                                                                                                           LEA
                       When the job starts
                                                                                            000E
15 0000
                                                                                    71 0052 4E42
                                                                                                           TRAP
                                                                                                                   #2
                                                                                                                                          open input file
16 0000
                      A6 = start of job area (assembler location counter 0)
                      A6 + A4 = start of jobs data area
                                                                                    72 0054 4A40
17 0000
                                                                                                           TST
                                                                                                                                          check for errors
                      A6 + A5 = top of data area, also top of stack
18 0000
                                                                                    73 0056 670A
                                                                                                           BEQ.S
                                                                                                                   INOK
                      A7 = top of stack -4, ie there are 2 zero words on the
                                                                                    74 0058 2054
                                                                                                                                          console channel ID
19 0000
                                                                                                           HOVEA.L (A4), A0
                                                                                    75 005A
                                                                                                                                          error code is in DO
20 0000
                           stack
21 0000
                                                                                    76 005A 3478
                                                                                                           HOVEA.W QUBUT.ERR, AZ
                                                                                                                                          call error printer
22 0000
                               This tells the QCODE assembler how much data
                                                                                            0000
             D.SPACE=256
                                                                                    77 005F 4F92
23 0000
                               space is to be allocated for the job.
                                                                                                           JSR
                                                                                                                   (A2)
24 0000
                                                                                    78 0060 60BE
                                                                                                           BRA.S
                                                                                                                   LOOP
                                                     entry point from EXEC
25 0000 600E
                      BRA.S
                              START
                                                                                    79 0062
                                                                                    80 0062 2948 INOK
                                                                                                                                          channel IB of input
26 0002
                      DS.B
                                                     make location counter 6
                                                                                                           MOVE.L A0.4(A4)
                               SAAFR
27 0006 4AFB
                      DC. U
                                                      flag for 9DOS - standard
                                                                                            0004
                                                                                                                   #MT.RELJB.DO
                                                                                                           MOVEQ
                                                                                                                                          release basic
28 0008
                                                     format job.
                                                                                    81 0066 7009
                                                                                                                                          basic job ID is O
29 0008 0753
                              7. SPOOLER'
                                                                                    82 0068 7200
                                                                                                           HOVEQ
                                                                                                                   #0.D1
                      DC. B
                                                      job name
        504F
                                                                                                           TRAP
                                                                                                                   #1
                                                                                    83 006A 4E41
        4F4C
                                                                                    84 006C
                                                                                    85 006C 7002
                                                                                                           MOVEO
                                                                                                                   #IO.CLOSE.DO
                                                                                                                                          close console
        4552
                                                                                                           MOVEA.L (A4), A0
30 0010
                                                                                    86 006E 2054
31 0010
                      define some QBOS constants
                                                                                    87 0070 4E42
                                                                                                           TRAP
32 0010
                                                                                    88 0072
                                                                                                           HOVER
                                                                                                                   WIO. OPEN, DO
                               open a channel
                                                                                    89 0072 7001
                                                                                                                                          open output channel
33 0010
             10.0PEN=1
             IO.CLOSE=2
                                                                                    90 0074 72FF
                                                                                                           HOVED
                                                                                                                   #-1.D1
34 0010
                               close a channel
                                                                                                           HOVED
                                                                                                                   #2,03
35 0010
                                                                                    91 0076 7602
             IO.FLINE=2
                               fetch a line of characters (lf) terminator
                                                                                                                   DUTFILE.AO
                                                                                                                                          output channel name
36 0010
                                                                                    92 0078 41FA
                                                                                                           LEA
             IO.FSTRG=3
                               fetch a string of bytes
                                                                                            0050
37 0010
             IO.SSTRG=7
                              send a string
                                                                                    93 007C 4E42
                                                                                                           TRAP
38 0010
             HT.FRJOB=5
                              force remove job from transient program area
                                                                                    94 007E 2888
39 0010
                                                                                                           HOVE.L
                                                                                                                  A0, (A4)
                                                                                                                                          save output channel ID
             MT.RELJB=9
                              release a job
                                                                                    95 0080
40 0010
             UT.ERR=SCC
                              print error message
                                                                                                                                          set up to read input
                                                                                    96 0080 7002 PLOOP
                                                                                                           HOVER
                                                                                                                   #10.FLINE,DO
41 0010
             ERR. B0=-5
                              buffer overflow
                                                                                    97 0082 7451
42 0010
                                                                                                           HOVER
                                                                                                                   #81,02
                                                                                                                                          max length allow 80 + 1f
43 0010 DYCE START
                                                                                    98 0084 76FF
                                                                                                           HOVEQ
                                                                                                                   #-1,D3
                                                                                                                                          timeout
                                                     A4 points to data area
                      ADDA.L
                              A6.A4
                                                                                    99 0086 43EC
                                                                                                                   $10(A4),A1
                                                                                                                                          buffer address
44 0012 7001
                      HOVED
                              #10. OPEN. DO
                                                     set up to open channel
job ID,-1 means current
                                                                                                           LEA
                                                                                            0010
45 0014 72FF
                      HOVED
                              #-1.D1
                                                                                   100 008A 206C
                                                                                                           HOVEA.L 4(A4), A0
46 0016 7602
                      HOVED
                              #2,03
                                                     2 means open new file
47 0018 41FA
                                                     address of channel name
                                                                                            0004
                      LEA
                              CONS. AO
                                                                                    101 008E 4E43
                                                                                                           TRAP
        0080
48 001C 4E42
                                                     open channel
                                                                                   102 0090 0040
                                                                                                                   #ERR.BO,DO
                                                                                                                                          check for buffer overflow
                                                                                                           CHPI
49 001E 2888
                                                                                            FFFB
                      HOVE.L
                              A0. (A4)
                                                     save console channel ID
50 0020
                                                     Now channel ID is in AO
                                                                                   103 0094 6608
                                                                                                           BNE.S
                                                                                                                   BOK
                                                                                   104 0096 5241
51 0020 2054 LOOP
                      HOVE.L
                               (A4).A0
                                                                                                           ADDO
                                                                                                                   #1,D1
                                                                                                                                          if so insert linefeed
                                                                                                                   #10.(A1)+
                      HOVEO
                              #10.SSTRG,DO
                                                                                   105 0098 12FC
                                                                                                           HOVE.B
52 0022 7007
                                                     set up to send string
                                                     number of bytes to send
53 0024 7405
                      HOVER
                                                                                            000A
                              #5,D2
54 0026 76FF
                              #-1,D3
                                                                                   106 009C 4240
                                                                                                           ELR
                                                                                                                   BO
                      HOVEO
                                                     indefinite timeout
55 0028 43FA
                                                                                   107 009E 4A40 BOK
                                                                                                           TST
                                                                                                                   Do
                      LEA
                              PROMPT.A1
                                                     point to buffer
       00A6
                                                                                   108 00A0 6614
                                                                                                           BNE.S
                                                                                                                   EXIT
56 002C 4E43
                      TRAP
                                                                                   109 00A2 5241
                                                                                                           ABDO
                                                                                                                   #1.01
                                                                                                                                          add a carriage return
                                                     send to output
                                                                                                                                          (some printers need it!)
57 002E
                                                                                   110 00A4 12FC
                                                                                                           HOVE . B
                                                                                                                   #13.(A1)+
58 002E 7002
                      HOVED
                              #IO.FLINE, DO
                                                     set up to fetch a line
                                                                                            0000
59 0030 7450
                      HOVER
                                                     max length to fetch
                                                                                   111 00A8 3401
                                                                                                           HOVE
                                                                                                                   D1.B2
                                                                                                                                          length
                              #80.92
                                                                                                                   #10.SSTRG.DO
                                                                                   112 00AA 7007
                                                                                                           HOUER
                                                                                   113 00AC 2054
                                                                                                           HOUEA.L (A4).A0
                                                                                                                                          output ID
                                                                                   114 00AE 43EC
                                                                                                           LEA
                                                                                                                   $10(A4).A1
Listing 2.
                                                                                            0010
                                                                                   115 0082 4E43
                                                                                                           TRAP
                                                                                                                   #3
100 REMark basic program to generate mdv1 spooler code
110 a=RESPR(1024):REMark reserve 1024 bytes of memory for code
                                                                                                                   PLOSP
                                                                                   116 00B4 60CA
                                                                                                           BRA.S
                                                                                   117 0086
120 RESTORE : i=0
                                                                                   118 0086 7002 EXIT
                                                                                                                   #10.CLOSE,DO
                                                                                                                                         close input and output
                                                                                                           MOVEO
130 REPeat rlin
                                                                                   119 0088 206C
                                                                                                           MOVEA.L 4(A4), A0
                                                                                            0004
     READ as,c:j=1:sum=0:IF as="END":EXIT rlin
140
                                                                                   120 00BC 4E42
150
      REPeat byte
                                                                                   121 00BE 7002 EXIT1
                                                                                                           HOVEQ
                                                                                                                   HIO.CLOSE,DO
160
       b=16*(CODE(a$(j))-48-7*(a$(j))"9"))+CODE(a$(j+1))-48-7*
                                                                                   122 00C0 2054
                                                                                                           HOVEA.L (A4),A0
       (a$(j+1)>"9")
                                                                                   123 00C2 4E42
                                                                                                           TRAP
                                                                                   124 0004
170
       POKE a+1,b:j=j+2:i=1+1:sum=sum+b
                                                                                   125 0004 7005
                                                                                                           HOVEO
                                                                                                                   #MI.FRJOB,DO
                                                                                                                                          exit current job
       IF j>=LEN(a$):EXIT byte
180
                                                                                                                                          job 10, -1 means current
                                                                                   126 00C6 72FF
                                                                                                           HOVER
                                                                                                                   #-1,D1
190
     END REPeat byte
                                                                                   127 00C8 4E41
                                                                                                           TRAP
                                                                                                                   #1
     PRINT SUM
200
                                                                                   128 00CA
210 END REPeat rlin
                                                                                   129 00CA 0004 CONS
                                                                                                           DC. U
                                                                                   130 00CC 434F
                                                                                                           DC.B
                                                                                                                   "CON "
215 DELETE MDV1_SPOOLER_CODE
                                                                                            4ESF
220 SEXEC "mdv1 spooler_code",a.i.256
                                                                                   131 0000
230 DATA "600E000000004AFB0753504F4F4C4552",1
                                                                                   132 00B0 4649 PROMPT
                                                                                                          DC.B
                                                                                                                   "FILE>"
240 DATA "D9CE700172FF760241FA00B04E422888",2
                                                                                            4C45
250 DATA "20547007740576FF43FA00A64E437002",3
                                                                                            3DFF
                                                                                   133 0006
260 DATA "745043EC00104E430C2C002A00106700",4
                                                                                                  *OUTFILE BC.W
                                                                                   134 0006
                                                                                                                                    output device name is 16 bytes
                                                                                                                    16
270 DATA "007E53413941000E700172FF760141EC",5
                                                                                                                     SCR_448x60a32x16
                                                                                   135 0008
                                                                                                           DC.B
280 DATA "000E4E424A40670A2054347800CC4E92",6
                                                                                   136 0006
290 DATA "60BE29480004700972004E4170022054",7
                                                                                   137 0006 0004 DUTFILE DC.W
                                                                                                                          use this OUTFILE instead to send output
                                                                                                                  4
                                                                                                         DC.B 'SERI' to a serial printer.
300 DATA "4E42700172FF760241FA005C4E422888",8
                                                                                   138 00D8 5345
```

5231

D.SPACE =00000100

10.FSTR6=00000003

I#0K =00000062 EXIII =000000BE

* *E0F

10.0PEN =00000001

ID.SSTRG=000000007

ERK.BO =FFFFFFFB

PLOOP

CONS

=000000080

=000000CA

139 00BC

140 00DC

310 DATA "7002745176FF43EC0010206C00044E43",9

320 DATA "0C40FFFB6608524112FC000A42404A40",10

330 DATA "6614524112FC000D34017007205443EC",11

340 DATA "00104E4360CA7002206C00044E427002",12

350 DATA "20544E42700572FF4E410004434F4E5F",13

360 DATA "46494C453DFF000453455231",14

370 DATA "END",1

=0000009E

In.EL 8SE=00000002

ml.FRJBB=00000005

PROMPI =000000000

START =00000010

BOK

10.FLINE=000000002

mf.RELJB=00000009

BUTFILE =000000DA

=00000020

#000000B6

LOOP

EXIT

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RESPONSE FRAME

Do you have a problem? Your manual is . incomprehensible or you just cannot get the hang of that programming trick you tried whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

SOUND ADVICE

I am the proud owner of an Amstrad 64. I am currently trying to write a Space Invaders type program. The thing that bothers me is that I can't really make head nor tail of the Envelope command. Although I can do simple things like Bleeping with

PRINT CHR\$(7)

I am totally at sea with more difficult things. Is there a simple way to get "laser fire" effects that I can use in my program without just experimenting with random parameters?

Janus y'Hadouzi, London SE15.

I AGREE THAT the Envelope can be pretty hard to master. Perhaps the best way to discover good sounds is to create a program which generates the sound parameters at random, makes the sound, and most importantly, then prints the relevant parameters on the screen so you can make a note of the ones which sound

You'll find you can try out many, many sounds very easily with such a program. To start you off, try including this in a program:

ENT - 2,6, - 1,2,2,5,1 The following line in your program

SOUND 2,196,497,13,0,2

This will show you how much you can produce in the sound department with your Amstrad and should fit your Space Invaders program.

80K SPECTRUM?

I am hoping to get a 48K ZX Spectrum. Before I decide to get one, I would like to know if it is possible to upgrade the memory with 80K with a 32K Ram pack. Stephen Peters,

Stoney Middleton.

YOU CAN UPGRADE a 16K Spectrum to 80K with a memory expansion kit from East London Robotics, but as far as I can determine, it is not possible to upgrade a 48K machine to 80K.

FASTER ELECTRON

I own an Acorn Electron and am very pleased with it, but I find it most frustrating when after typing out games written for the BBC Micro - to find that they are very slow. This, of course, very much limits the attraction of the game. I've found that even games by software houses which are written in machine code for the BBC such as A&F's Chuckie Egg run at a snail's pace. Is there any way in which I can speed up games with such things as a special Poke, or a short assembler routine?

Neil Smith,

Finchfield, Wolverhampton.

THERE ARE A NUMBER of ways you can speed programs up. Remove as many spaces from the listings as possible, and use multi-statement lines where possible. Resident integer variables - such as A% run more quickly than any other variables, so use these if you can. It appears that, especially in shorter programs, Gotos and Gosubs run more quickly than procedures.

Put frequently called Gosubs as close to the start of the listing as you can. As a general rule, low-resolution screen modes - 4,5 and 6 - tend to run more quickly than 0 through to 3, so try the effect of modifying the

SCREEN EFFECT

I have written a number of useful programs for my own use, and have incorporated various Screen\$ to look at while the main program is loading. However, after loading the Screen\$, and the main program has started loading, the computer prints up "program: name" right in the middle of my carefully-drawn Screen\$, ruining the whole effect. I cannot predict where this line is going to be printed. Is there any way of preventing the computer from printing the program name when it starts to

Ian Philpot, Tonbridge,

Kent.

THE EASIEST WAY to do this is to leave the top line of your Screen\$ blank, and ensure the Ink and Paper colours are finally set to the same colour. You then end with a Print At 0,0; which will put the "program: name" message - invisibly - on the top line. If you would prefer to use the bottom part of the screen, rather than the top line, you can use Poke 23659,0 to make the bottom lines available, and use Print At 24,0;. If you do this, you need to make Poke 23659,2 the first line of your main program, or else your main program will crash.

HALL OF FAME

I have recently been developing a Hall of Fame for a game I am programming, but I cannot seem to get it to work. I have tried various different ways, yet still I have had no luck. Could you please put me out of my suspense and tell me how I could do it?

C Jones, Appley Bridge.

I WAS SURPRISED to discover that it was not as simple to do this as I had thought when first reading your letter. After quite a bit of experimenting I came up with the following. It will work as listed on the Spectrum or QL, and on most other machines by deleting the comma and second 10 in the A\$ Dim statement.

If you run this, you'll see scores being generated at random, with a random letter for the name of the winner. You'll also see the table being constantly updated.

10 DIM A\$(10,10):DIM B(10)

20 FOR J = 1 TO 10 30 A\$(J) = "Z" 40 NEXT J

SCORE = INT(RND 100) + 1 N\$ = CHR\$(64 + INT(RND 26))

GO SUB 160

90 PRINT "SCORE IS ";SCORE

100 PRINT 110 FOR J = 1 TO 10

120 PRINT A\$(J),B(J)

130 NEXT J

140 FOR T = 1 TO 300:NEXT T 150 GO TO 50

160 FLAG = 0

170 FOR J = 10 TO 1 STEP - 1

180 IF SCORE>B(J) THEN FLAG = J 190 NEXT J

200 IF FLAG = 0 THEN RETurn 210 FOR J = 10 TO FLAG STEP - 1

220 B(J = B(J - 1)

230 A\$(J) = A\$(J - 1) 240 NEXT J

250 B(FLAG) = SCORE

260 A\$(FLAG) = N\$ 270 RETurn

COPYRIGHT ROM?

We are writing a program for the Spectrum which we wish to sell. Its main function is performed by Calls to the Rom. A lot of commercially-available programs also do this. However we would like to know if it infringes Sinclair's copyright on the Rom.

C Stockley,

Dorset.

USING THE Rom in this way comes well within the "normal use" of a computer. There are no copyright problems.

DRAGON FORTH

I own a Dragon 32, and have lots of games for it. I recently started machine code programming, but have encountered a problem. A lot of my games run automatically on loading, but nowhere in any machine code books can I find details of how to do this. Secondly, I am looking for a Forth compiler for the Dragon. There are several on the market, but I don't know which is the best value for money. Can you recommend one?

David Kelsey, Saxby-on-Humber, Grimsby.

ACCORDING TO the Dragon Data magazine Dragon World there is no easy way to achieve an auto-run on the Dragon. In regard to the Forth question, I read a very good review of the Forth from Oasis Software. The Dragon Dungeon praised the Forth from Oasis quite highly. It comes with a 58-page booklet, and allows you to use Dragon graphics and

sound. Of special interest is a demonstration program which shows the dramatic speed difference between Forth and Basic.

INPUT PROBLEM

I am presently writing an adventure program and have encountered a problem, which involves the input of commands into the program. For example if I wanted to go to the north with a commercial adventure I would just type in Go North and the computer would know what to do. I am looking for a subroutine that is connected to the word that is, move north to a new location.

Matthew Norman, Oldbury Warley.

THE ROUTINE you include in your letter is messy. It is also unnecessary. If you insist your player start a direction command with "Go" you only need to check the fourth letter of the input to see what direction the person wishes to move. You could simply use the following - assuming that you have already checked to see that the first two letters of the input are "Go", and assuming the input string is A\$: IF A\$(4) = "N" THEN GOSUB ...
IF A\$(4) = "S" THEN GOSUB ...
IF A\$(4) = "E" THEN GOSUB ...

IF A\$(4) = "W" THEN GOSUB

ZX-81 INPUT

I know it is easy on the Spectrum to direct the computer to put an input anywhere on the screen. However, I have a ZX-81, and I would like to be able to do this on my computer.

Robert Geeson,

Edinburgh.

THIS PROGRAM, from Michael Erichson allows you to make an input anywhere on the screen:

10 PRINT "QUESTION?";

LET A\$=

30 FOR N = 1 TO 32 40 IF INKEY\$ = "" THEN GOTO

50 IF CODE INKEY\$ = 118 THEN

GOTO 120 60 LET A\$ = A\$ + INKEY\$ 70 IF INKEY\$<>'''' THEN GOTO

100 PRINT A\$(N);

110 NEXT N

130 PRINT AS

140 PRINT LEN A\$

MC FOR THE ORIC

After reading Your Computer for several months now, I have noticed that quite a few Spectrum owners want to start programming in machine code. I am an Oric owner in the same position, but I cannot find any books specifically for the Oric. Could you tell me about any books for beginners? D Edmards

Tiverton, Devon.

GRANADA PUBLISHING have three Oric books which should be helpful to you. These are: Oric and Atmos Machine Code (Ian Sinclair - £6.95), The Oric 1 - and how to get the most out of it (Ian Sinclair - £5.95), and The Oric Programmer (S M Gree and Mike James, £6.95).

CHALLENGING



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Chambers

M Bristow, Alderney, Channel Islands.



You PLAY the part of Spiteful Sorcerer Sly's apprentice. He has locked you in the cellar of his tower full of mysterious rooms and chambers. To test your intelligence he has given you the task of finding your way out through an exit on the fifth floor. But not only this, you must also collect one of each of the valuable objects left in the rooms, or he may cast a spell on you. Just to make it more difficult, Sorcerer Sly has put a few hazards on the way!

Press M to see your position on the map at any time during the game, but be warned you

can see the maps only a limited number of times. Press I to see what items you have collected so far.

Press 0 if you want to unlock an invisible door. But remember, if you press it at the wrong time, you will fall through the floor — creating a trap door. Press cursor keys (5-8) to move through the maze.

To reach the level above you, you must reach one of the exits on the outside walls. You may find it useful to collect a lantern, a cross and a magic key to help you on your way!

Program notes.

10 Sets up variables.

20 Constructing maze.

25 Loop for number of levels.

30-90 Draw room which you are in.

95 Moves man to centre of room.

96 Sees if you have come across an object or a hazard. 97 Sees if you have come across vanishing room.

98 Sees if you have come across a va pire bat.

100-140 Waits for you to press a key a responds accordingly.

150-170 moves man out of door.

180-190 checks to see if you have got c of maze.

200-290 End of game and an assessm∈ of your intelligence.

300-380 Reacting to you trying to g through an invisible door.

400-490 Draws map — if you have any le 500-590 tells you what type of object hazard you've come across.

700-710 Lists the items you are carrying 800-850 Vanishing room.

900-940 Vampire bats.

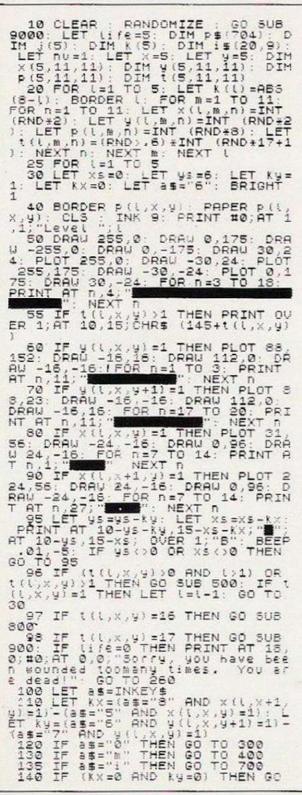
9000 Reads and Pokes Data for usi defined graphics.

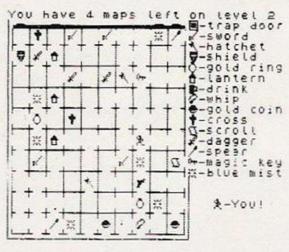
9010-9060 Data for graphics.

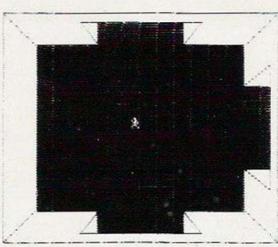
9090 Reads Data for objects and hazard 9100-9200 Data for objects and hazards. 9210-9300 Asks you to wait while maze constructed.

9999 Saves and Verifies a copy Chambers.

Simply type in the main program and Save copy of it by Entering Goto 9999. Then I wind tape and press play to Verify it.







TO 100

150 LET ys=0: LST xs=0

160 LET xs=xs+kx: LET ys=ys+ky:
PRINT AT 10+ys-ky, 15+xs-kx; """;
AT 10+ys, 15+xs, 0UER 1; "B"

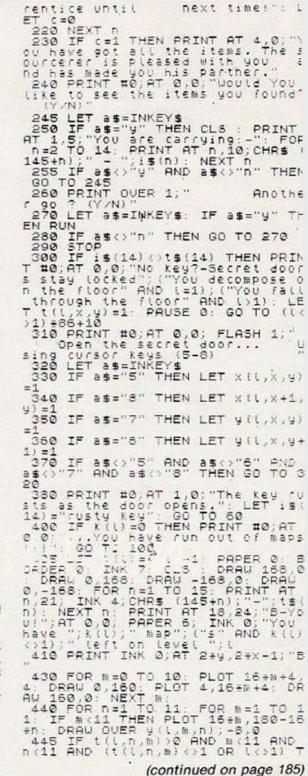
170 BEEF .01, -5: IF 8-ABS ys>0

AND 13-ABS xs>0 THEN GO TO 160

180 LET x=x+kx: LET y=y+ky: IF
x>0 AND x<11 AND y>0 AND y<11 TH
EN GO TO 40

190 PRINT #0; FLASH 1; AT 0,0; "
YOU have found one of the exits
Press a key for next level."; AT
1,12; ("to get out of maze." AND
LET x=x+kx: LET y=y+ky: IF
x>0 AND x<11 AND y>0 AND y<11 TH
EN GO TO 40

190 PRINT #0; FLASH 1; AT 0,0; "
YOU have found one of the exits
Press a key for next level."; AT
1,12; ("to get out of maze." AND
NEXT (
200 CLS: PRINT AT 1,10; "UELL D
ONE" "YOU have managed to escape
from the fifth level alive."
210 LET c=1: PRINT AT 4,0: FOR
n=2 TO 14: IF i\$(n)<>t\$(n) THEN
PRINT AT 4,0: "But you did not ha
ve all the items required by
the sorcerer. You remain an app



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```
(continued from page 183)

HEN PRINT INK 0: AT 2*m, 2*n-1; CHR

$ (145+t(l,n,m))

450 IF n(11 THEN PLOT 16*m-12,1

76-16*n: DRAU OVER x(l,m,n); 0.-8

460 NEXT m: NEXT n

470 INK 9: FOR m=4 TO 164: OVER

1: PLOT 4,m: DRAU 160,0

480 IF INKEY$="" THEN NEXT m: G

O TO 470

490 OVER 0: PAUSE 0: GO TO 40

500 FOR n=9 TO 11: PRINT AT n,1

4;"": NEXT n

530 FOR n=15 TO 1 STEP -1: BEEP

.01,n: NEXT n

540 LET t=t(l,x,y): PRINT AT 10
,15; CHR$ (145+t); #0; AT 0,0; "YOU have come across a "; t$(t): IF t
>1 AND i$(t)=t$(t) AND t(16 THEN PRINT #0; AT 1,0); "BUT it breaks

Up in your hands!!"

550 IF t=1 THEN FOR n=7 TO 13: PRINT AT n,12; "ENEXT n: PRINT AT n,12; "ENEXT n: PLOT 96,119: DRAU 55,0: DRAU 0,55: DRAU 0,55: DRAU 54,-54: DRAU -55,0: DRAU 54,54: FOR n=8 TO 12: PRINT BRIGHT 0:A

T n,13; INK p(l-1,x,y); """
NEXT n: PRINT #0; "YOU fall into the chamber below.": PAUSE 0

560 IF t=15 THEN PRINT #0; AT 1,0; "It absorbes all your possessions:
PRINT AT 0,0; OUER 1; PAPER 5; INK 1; FLASH 1; P$: DIM i$(20,9): S90 LET i$(t)=(t$(t),x,y)=(t(l,x,y)=1)+(t(l,x,y)) AND t(l,x,y)>15): RETURN
```

/WW CLS : PRINT AT 1,5; "You are carrying: ": FOR n = 2 TO 14: IF i\$ (n) = 1\$ (n) = "rusty key" THEN PRINT AT n, 10; CHR\$ (145+n); "-a "; i\$ (n) = "rusty key" THEN PRINT AT n, 10; CHR\$ (145+n); "-a "; i\$ (n) = 20.50 TO 30 600 PRINT AT 0,0; PAPER 7; INK 0; OUER 1; FLASH 1; p\$ 810 LET t=0: FOR n=1 TO 14: IF i\$ (n) = t\$ (n) THEN LET t=0 620 NEXT n 630 IF i\$ (6) = t\$ (6) THEN LET t=0 640 IF t>1 THEN PRINT #0; AT 1,0; "room. You've lost your "; i\$ (t): LET i\$ (t) = " " PAUSE 0: RETURN 650 PRINT #0; AT 1,0; "room. Luck ity nothing vanished.": PAUSE 0: RETURN 900 PRINT #0; AT 1,0; "Bat. Press a key to attack it.": PAUSE 0: PRINT #0; AT 0,0; "Bat. Press a key to attack it.": PAUSE 0: PRINT #0; AT 0,0; "OUT AT 10,1 5; "S": AT 10,15; ("0" AND 10 2=INT (10,2): BORDER m: FOR n=20 TO 1 STEP -1: BEEP .005, n+m: NEXT n: NEXT m 920 IF i\$ (10) = t\$ (10) THEN PRINT AT 10,15; ""; #0; AT 0,0; "You have killed the vampire bat with your cross.": LET t(l,x,y) = 0: RETURN 930 LET life=life-1: IF life>0 THEN PRINT #0; AT 0,0; "You are wounded. You have "; life; "You are wounded. You have "; life; "CHR\$ 8+" " " AND life(>1); "e"; "S" AND life<>1); "eft. Escape while you can " RETURN 940 RETURN 900 RESTORE 900; FOR n=USR "a"

TO USR "s"+7: READ a: POKE n,a:
NEXT n
9010 DATA 153,102,102,153,153,10
2,102,153
9015 DATA 48,176,152,116,20,112,
136,134,255,129,109,109,189,189,
129,255
9020 DATA 1,2,4,8,208,160,206,12
8,32,48,240,104,40,4,2,1,127,119,
119,65,119,54,54,28,56,56,68,13
0,130,130,68,56
9030 DATA 16,56,124,254,68,68,68
124,0,120,127,121,121,127,120,1
20,14,49,55,66,60,0
9040 DATA 24,24,126,126,24,24,24,24,24,0,126,132,132,66,66,33,126,3
9050 DATA 3,7,6,8,16,32,64,128,0
0,64,160,191,165,68,0,0,0,146,84
,0,198,0,84,146,0
9060 DATA 0,0,0,0,0,0,3,110,
126,56,112,96,224,128
9090 DIM t\$(20,9): RESTORE 9100:
FOR n=1 TO 17: READ a\$: LET t\$(
n)=a\$: NEXT n
9000 DATA "trap door" "sword" "h
atchet" "shield" "90ld ring" "ta
ntern" "srineld" "90ld ring" "ta
ntern" "shield" "90ld ring" "ta
ntern" "srineld" "90ld ring" "ta

Bug Eater

S Shirley, Aglestone, Leicestershire.



BUG EATER RUNS on a CBM-64 with joystick in port two. It uses sprites, user-defined characters and limited sound. In writing this program I have explored most features of the CBM-64 and also learnt some useful programming techniques.

- The use of For-Next loops instead of if there loops in order to increase speed.
- The need to minimise the number of Peeks, Pokes and If-Thens in the main loop because they are so flawless.
- The use of integer variables instead of numbers in order to increase speed.
- The use of boolean arithmetic to replace If-Then statements. If should be noted

that though this saves space it also slows things down.

Never use Def FN as this is really slow.
 The importance of efficient program structure in terms of executive time.

If you think the program is initially slow then kill line 132 which serves as a speed control. To make the clumps of grass a bit more of a challenge then change the following line:

(continued on page 189)

```
S PRINT"D": GOSUB 9000 DIM P(300)
10 GOSUB 7000
10 FOR PEX TO ZX
132 FOR MOCKTO CX
132 FOR MOCKTO CX
132 FOR MOCKTO CX
132 FOR MOCKTO CX
133 FOR MOCKTO CX
134 FOR MOCKTO CX
135 FOR MOCKTO CX
136 FOR MOCKTO CX
137 FOR MOCKTO CX
138 FOR MOCKTO CX
139 FOR MOCKTO CX
130 FOR MOCKTO CX
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131 FOR MOCKTO CX
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135 FOR MOCKTO CX
136 FOR MOCKTO CX
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138 FOR MOCKTO CX
139 FOR MOCKTO CX
130 FOR
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ALTER screens colours (general or specific) AUTO line numbering BREAK out of code loops CLOCK digital clock CURSOR CONTROL CODES allow strings to have complex shaps
DEF KEY user definable keys
DEETE a block of lines
DO-LOOP structure
DPOKE double poke
EDIT specified line
ELSE (used with IF . THEN)
EXIT leave DO-LOOP

FILL enclosed area with specified ink or paper GET wait for keypress JOIN two program lines KEYIN a string KEYWORDS new keywords on/off LIST/LIST line TO line USED (used with GOTO, GOSUB) ON ERROR trap errors (with LINE, STAT and ERROR) (with LINE, STAT and ERRORI PLOT a string Imay contain cur control codes! POKE a string POP Basic's stack PROC, DEF PROC, END PROC (for named procedures)

RENUM versitile renumber ROLL all or part of screen in any direction by specified number of pixels, with or without attributes SCROLL like ROLL, but without

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SORT arrays (very fast)
SPUT program lines
TRACE program execution
UNTIL used with DO or LOOP
USING used with PRINT
WHILE used with PO or LOOP
XOS, YOS move PLOT origin
XRG, YRG change PLOT scale

FUNCTIONS

AND (bit-by-bit)
BINE decimal to binary
CHARS number to 2 characters
COSE test cosine
DEC hexadecimal to decimal
DPEEK double PEEK
FILLED filled area

HEX8 decimal to hexadecimal INSTRING string search MEM free memory MEMORY's all of memory as a string RNDM fast RND SCRN® recognises user graphics SINE fast sine STRING® repeats strings TIME\$ current time USING® formats numbers VOR (Nb. b. bit)

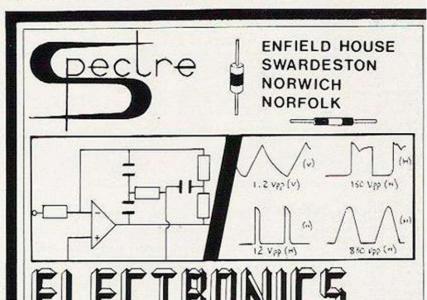
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48 K SPECTRUM



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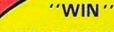
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Cat Walk, Billy Bluebottle, Bouncing Berry, Eskimo Capers, Incorporate English, French, & German instructions.

(continued from page 185)

10200 DATA 255,240,3,255,240,3,255,240, 3,255,240,3,255,240,0,255,192,0

In order to minimise the number of Pokes I use a small piece of machine code which fills the colour screen before the main loop begins. The data for this piece of relocatable machine code is in line 10000 - check it before running. Between running the program and the title screen appearing is a short delay while the character set is redefined and the sprite data set up. You get a bonus life every five levels.

Graveyard-20

R W Silverside. Whickham, Newcastle upon Tyne.

THE AIM OF the game is to collect the sets of keys which are scattered around the graveyard. Every time you get all the sets of keys on the screen, the screen is reset with one more key.

As you move around the grid you destroy the squares which you step on, returning to one of these spaces will result in your destruction, as will stepping off the side of the grid. By pressing the space-bar the row which you are in is reprinted, and this can only be done if you have more than 200 points because it decreases your score by 200.

Destroys the bibles

This action also destroys all bibles in the row you are in. Every five screens cleared will result in another ghost appearing. The ghosts can reach a maximum of four. The skull and cross bones scattered everywhere must be avoided and if one of these is hit you will be destroyed. Also, all the sets of keys must be collected before 30 seconds have elapsed — the time is shown in middle of top line. If this is not achieved, you will again be destroyed.

Your score is in the top left-hand corner of the screen, and the number below this is the highest score. When the game ends, the opening screen is printed out again and the program runs again after about 10 seconds. Occasionally, when a new game should start, the program stops running and prints an error message. The program can be restarted by typing Run Stop-Restore and running the program again.

10 POKE36879,28:POKE36878,8:PRINT": ""

20 PRINTSPC(110)"### SSSS GRAVEYARD-20⊾% PRINT" BOBY R.W. SILVERSIDES" 40 PRINTSPC(76)"端網Y期間的*H期間間" 50 PRINT" NTO RE-FILL A ROW PRESS SPACE" 60 POKE51,255:POKE52,27:POKE55,255:POKE56,27 70 FORA=0T0511:POKE7168+A, PEEK(32768+A):NEXT FORR=0T0111:READAR:POKE7168+A, AA:NEXT 90 DATRO,60,60,126,36,36,24,255,189,189,189,60,36,36,36,36,102 100 DATA0,0,0,24,60,126,90,126,126,126,126,126,84,84,0,0 110 DRTR0,0,0,0,24,60,90,126,36,24,66,231,24,24,231,66

120 DATR0,0,0,62,62,62,54,34,54,54,62,62,62,0,0,0 130 DRTR0,0,60,102,60,24,24,24,24,24,30,28,30,24,24

168 PRINT "7" : POKE36869, 255 170 FORZ=0TO4:READBB(Z):NEXT

180 DATA1,1,16,8,1

190 DR=BB(4):POKE36879,156

200 FORR=0T09:FORRA=1T020:POKE7724+R#44+RA,10:POKE7746+R#44+RA,11

210 POKE38444+R#44+RR,5:POKE38466+R#44+RR,5:NEXTRR:NEXTR

220 FORB=0T04:FORC=1T0BB(B)

230 DD=(INT(RND(1)*10)*44)+(INT(RND(1)*20)+7725)

240 IFB=1THENS(C)=DD IFB=OTHENM=DD 258

260 IFPEEK(DD)<>10THEN230

270 Z=1:IFB=2THENZ=6 280 IFB=3THENZ=2

290 POKEDD, B#2: POKEDD+22, B#2+1

300 POKEDD+30720,Z:POKEDD+30742,Z:NEXTC:NEXTB

310 TI\$="000000"

320 PRINT" ## "SC, RIGHT\$(TI\$,2), HS

330 MA=M:MA=MR+(PEEK(197)=19)-(PEEK(197)=43)-44*(PEEK(197)=35)+44*(PEEK(197)=11)

340 IFMA<77240RMA>8141THENMA=M:GOTO410

350 IFPEEK(MA)=320RPEEK(MA) * 20RPEEK(MA) = 4THEN500

IFPEEK(MA)=10THENSC=SC+10:POKE36876,150 IFPEEK(MA)=6THENSC=SC+100:POKE36876,250

IFPEEK(MA)=8THENSC=SC+200:POKE36876,DA+200:DA=DA-1:IFDA=0THEN620

390 POKEM, 32: POKEM+22, 32: M=MA: POKEM, 0: POKEM+22, 1: POKEM+30720, 0: POKEM+30742, 0

400 IFPEEK(197)=32THENGOSUB550

410 :POKE36876,0:FORC=1TOBB(1) 428 EE=INT(RND(1)#4)

430 SR=S(C):SR=SR+(EE=0)-(EE=1)+44*(EE=2)-44*(EE=3)

440 IFPEEK(SR)<>10ANDPEEK(SR)<>0THEN470

450 IFPEEK(SA)=0THENGOSUB660:GOTO500

460 GOSUB660 470 NEXT

480 IFTI\$>"000030"THEN500

490 GOT0320

500 POKEM, 32: POKEM+22, 32: M=MR: POKEM, 12: POKEM+22, 13

510 FORMU=255T0128STEP-1:POKE36877,MU:NEXT:POKE36877,0

520 RESTORE

530 FORT=1T02500:NEXT:IFSC>HSTHENHS=SC

540 SC=0:POKE36869,240:GOTO10

550 IFSC<200THENRETURN 560 SC=SC-200

570 H=INT((M-7724)/44)*44+7724:FORHR=1T020:HB=PEEK(H+HA):IFHB=320RHB=6THENHB=10 580 POKEH+HA,HB:POKEH+HA+22,HB+1

590 HC=5: IFHB=4THENHC=6

600 IFHB=8THENHC=1

610 POKEH+HR+30720, HC:POKEH+HR+30742, HC:NEXTHR:RETURN

620 POKEM,32:POKEM+22,32:M=MA:POKEM,0:POKEM+22,1:BB(4)=BB(4)+1:BB(1)=INT(BB(4)/5

630 FORMU=128T0255:POKE36876,MU:NEXT:POKE36876,0 640 FORT=1T02000:NEXT:TI\$="000000":IFBB(4)=21THEN680

650 GOTO190

660 POKES(C), 10: POKES(C)+22, 11: POKES(C)+30720, 5: POKES(C)+30742, 5 S(C)=SA:POKES(C),2:POKES(C)+22,3:POKES(C)+30720,1:POKES(C)+30742,1:RETURN

680 POKE36869,240

690 PRINT" THE GRAVEYARD" : PRINT SAVED THE GRAVEMAN FROM THE HORRORS OF ";

THE GRAVEYARD": PRINT"YOUR SCORE WAS"SC

710 PRINT"DO YOU WANT ANOTHER GO (Y/N)":INPUTAS 720 IFAS="Y"THENRUN

Light Bikes

R Pearmain, Grimsby, South Humberside.



LIGHT BIKES is a game for the Amstrad CPC-464. The game is for two players in which each player must kill off the opponent. Full instructions are in the program. The keys used are:

Player 2 Player 1 Up W Up: Left A Left * Right S Right + Down Z Down?

There is also a time limit, and a tune built into the program.

10 ON BREAK GOSUB 930

20 v=3

30 REM ****LIGHT BIKES**** 40 REM **COPYRIGHT 1984**

KEIT

60 REM

70 MODE 1

80 INK 0,0

90 CLS

100 INK 2,0 110 PEN 2

120 CLS

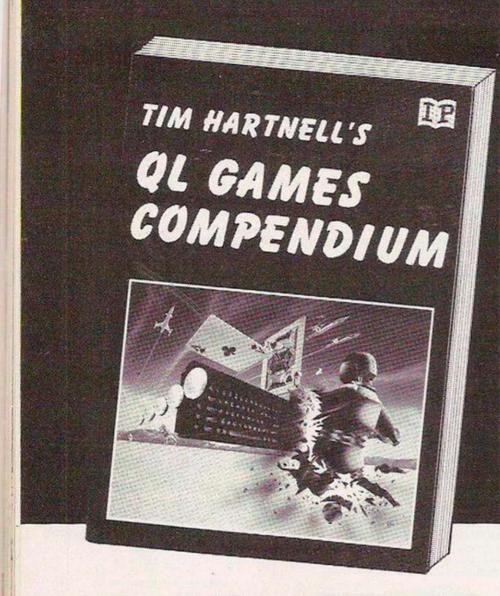
130 GOSUB 640

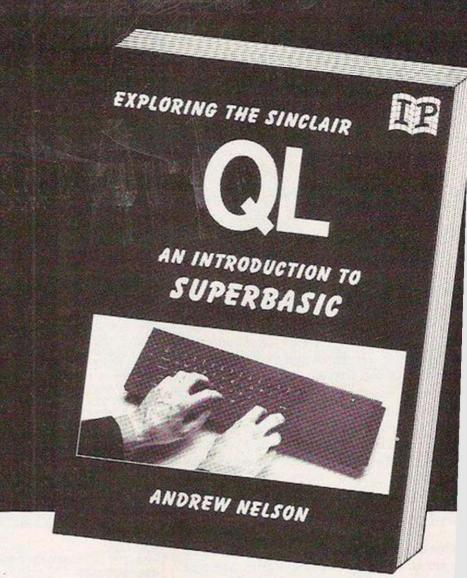
140 CLS

150 MODE 0 160 INK 4,13 170 INK 2,20: INK 3,6 180 INK 1,10,20 200 a=24:b=319:c=350:d=319 210 e=1:f=0:g=-1:h=0 220 REM set up screen 230 LOCATE 1,1:PEN 2:PRINT"Time left-" 240 PEN 1:PLOT 0,382,1:DRAW 639,382,1:DRAW 639,0,1:DRA W 0,0,1:DRAW 0,382,1 250 FOR n=79 TO 559 STEP 80:PLOT n,382,4:DRAW n,0,4:NE

(continued on page 191)

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(continued from page 189)
260 FOR n=70 TO 382 STEP 80:PLOT 0,n,4:DRAW 638,n,4:NE 610 GOTO 830
XT n
                                                           620 DI:CLS:SOUND 1,1000.50,15,0,0.1:SOUND 2,2000,50,15
270 REM ***start game***
                                                           ,0,0,1:FOR n=1 TO 100:NEXT:EI
                                                           630 RETURN
280 PLOT b,a,2:PLOT d,c,3
                                                           640 REM ***INSTRUCTIONS***
281 SOUND 1,2500,10,3,0,0,1:SOUND 2,2400,10,3,0,0,1
290 REM ***check player one***
                                                           650 PRINT TAB (15); "LIGHT BIKES"
                                                           660 INK 2,2,10
300 IF INKEY(59)=0 THEN e=1:f=0
310 IF INKEY (71)=0 THEN e=-1:f=0
                                                           670 SPEED INK 50,50
320 IF INKEY(60)=0 THEN e=0:f=1
                                                           680 INK 3.0
330 IF INKEY(69)=0 THEN e=0:f=-1
                                                           690 PEN 3
360 REM ***check player one***
                                                           700 RESTORE 890: PRINT: PRINT" Welcome contestants to the
370 IF INKEY (26) =0 THEN g=1:h=0
                                                            most deadly
380 IF INKEY(30)=0 THEN g=-1:h=0
390 IF INKEY(28)=0 THEN g=0:h=1
                                                           710 PRINT"game of all time. Each of you will be in "
                                                           720 PRINT"control of a light bike. One will be of
400 IF INKEY(29)=0 THEN g=0:h=-1
                                                           730 PRINT"the colour blue (beta class 7 model),
                                                           740 PRINT"and the other will be of the colour red "
410 a=a+2*e:b=b+4*f:c=c+2*g:d=d+4*h
                                                           750 PRINT"(zepha class 15 model). Your objective is"
420 REM ***check crashes***
430 ti=ti-1: IF ti=0 THEN GOSUB 520
                                                           760 PRINT"to kill of the opponent by trapping him "
                                                           770 PRINT"with your laser traces.Good luck, you'll "
440 LOCATE 10,1:PRINT ti
450 x=TEST (b,a)
                                                           780 PRINT"need it!!!"
460 y=TEST (d,c)
                                                           790 INK 3,15
470 IF x=4 OR y=4 THEN 510
                                                           800 LOCATE 10,24:PEN 2:PRINT "Fress any key to play":P
480 IF x<>0 AND y<>0 THEN 520
490 IF x<>0 THEN 550
                                                           EN 3
                                                           810 IF INKEY$="" THEN GOSUB 860:GOTO 810
500 IF y(>0 THEN 590
                                                           820 RETURN
                                                           830 IF INKEY$<>" " THEN 830
510 GOTO 280
                                                           840 SOUND 1,100,50:SOUND 2,90,50:SOUND 4,110,50
520 GOSUB 620
530 MODE 1:PRINT "Hard luck contestants. You both crash
                                                           850 GOTO 70
                                                           860 READ note: IF note=0 THEN RESTORE 890: v=3
ed!"
                                                           870 SOUND 1,note,50,v:SOUND 2,note+2,50,v:SOUND 4,note
540 GOTO 830
550 GOSUB 620
                                                           +4,50,v
560 MODE 1:PRINT "Well done Red bike."
                                                           880 RETURN
570 PRINT "May the blue rider rest in peace."
                                                           890 DATA 716,758,851,956
                                                           900 DATA 716,758,851,956
580 GOTO 830
590 GOSUB 620:MODE 1:PRINT "Well done Blue bike."
                                                           910 DATA 716,758,851,956
                                                           920 DATA 478,478,478,0
600 PRINT "May the Red Rider rest in peace."
                                                           930 GDTD 60
```

Alien Wars

A Smith, Luton, Bedfordshire.



ALIEN WARS is a shoot-'em-up game using player/missile graphics. Aliens come straight down the screen or zig-zag bouncing off the sides. They also drop bombs. You must shoot them before they reach the bottom of the screen or the Aliens are safe. If 20 aliens sur-

vive, the game is over. You also have five lives and colliding with an alien or a bomb loses a life.

The data lines in the program are a machine-code routine so the program should be CSaved before running.

```
10 REM #### RITRI BRSIC ###

20 REM #### RITRI BRSIC ###

30 REM #### 20-40# *######

40 REM #### 20-40# *#######

100 Intilocore=100 GRAPHICS 6

110 GUN=100F90 SP0 IV-51 SCORE=0

100 GUN=100F90 SP0 IV-51 SCORE=0

100 GUN=100F90 SP0 IV-51 SCORE=0

100 IF IT THEN T-0- GOSUB 9000 GOSUB 9000

200 GOSUB 9000 GOSUB 9500

200 GOSUB 900 GOSUB 900 GOSUB 9500

200 GOSUB 900 GOSUB 900 GOSUB 9500

200 GOSUB 900 G
```

(continued on next page)

(continued from previous page)

31020 DATA 255,6,142,253,6,24,169,0,109,253,6,24,109,252,6,133,204,133 31030 DATA 206,189,240,6,133,203,173,254,6,133,205,189,248,6,170,232,46,258 31040 DATA 6,144,16,168,177,203,145,205,169,0,145,203,136,202,208,244,76,87 31050 DATA 6,160,0,177,203,145,205,169,0,145,203,200,202,208,244,174,253,6 31060 DATA 173,254,6,157,240,6,189,236,6,240,48,133,203,24,138,141,253,6 31070 DATA 109,253,6,133,204,24,173,253,6,109,252,6,133,206,189,240,6,133 31080 DATA 205,189,248,6,170,160,0,177,203,145,205,200,202,208,248,174,253,6 31090 DATA 169.0.157.236.6.202.48.3.76.2.6.76.98.228.0.0.104.169 31100 DATA 7,162,6,160,0,32,92,228,96 31200 DATA 129,153,189,189,219,255,255,189,165,165 31300 DATA 0,36,36,36,36,36,0,0 31400 DATA 36,36,60,60,126,126,255,24,60,126

Shade Copy

I J Abbott, Doncaster, South Yorkshire.

ECTRUM

SHADE COPY IS a routine for the 16/48K Spectrum connected to a Sinclair ZX or Alphacom 32 printer. It has two advantages over the Spectrum Copy command. First, it allows you to copy all - including the bottom two lines - or any part of the screen. Secondly, it provides three modes of operation, namely normal, inverse and shaded copy.

Instead of transferring ink or paper dots from the screen to the printer, the shading routine looks at the affecting Ink and Paper attributes - not the Bright or Flash attributes - and converts the dots into one of eight shading patterns corresponding to their colours before sending to the printer.

The parameters for the routine are specified

in the same command as the USR call rather than being Poked in separately. The routine can be activated by a command such as: Randomise mode Or first And depth <>USR copy where Mode, First and Depth are numeric expressions and Copy is the address of the routine. Randomise whould be replaced by "Let dummy=" if your program uses the RND function.

The syntax of the command may be distinctly meaningless, but as far as the Spectrum is concerned, it is a perfectly valid expression and gets through the syntax check satisfactorily. If the sub-expressions Mode, First or Depth contain any comparison or logical operators then they may need to be enclosed in parentheses.

Since the operators Or, And and <> are in increasing order of priority, the value of Mode, First and Depth have been placed on the calculator stack by the time the USR Copy is reached.

The routine reads these values off the

Norma

calculator stack. Mode can take the following values:

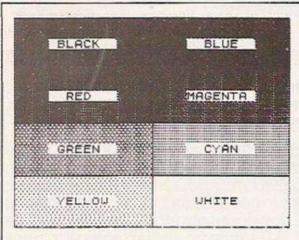
- 0: normal mode
- 1: inverse mode
- 2: shaded mode

First can take values in the range 0 to 191 and specifies the first line of pixels to be handled, zero being top line of the display. Depth specifies the number of pixel lines to be handled.

To get the routine into the machine, type in the longer-than-average hex loader program which is fairly fool-proof and quite fun to use as hex loaders go — and should speed up the task of entering the data. Alternatively, a shorter loader program could be used. If you typed it in, save it as it may be useful for entering other hex dumps in the same fairly common format.

Now run the loader program and enter the hex and the checksums. The program will then save the code so have a tape ready. Although the code was entered at address 32289 - for the benefit of 16K owners; how come you bought a printer before a RAM expansion? - in fact the code is fully relocatable and will load and work at any address above RAMtop - 48K owners breathe a sigh of relief. The routine is 311 bytes long and uses the printer buffer as a work area.

The colour demo program shows the shading patterns used to represent colours and the screen\$demo program dumps a screen\$ file in each mode for comparison.



COLOUR DEMO PROGRAM)

10 INK 0: PAPER 7: BRIGHT 0: F LASH 0: CLEAR 32288: OUER 0: INV ERSE 0: RESTORE 20 LET COPY=32289: PRINT "LOAD SHADE COPY": LOAD "SHADE COPY"C ODE COPY: CLS 30 FOR C=0 TO 6 STEP 2 40 FOR I=1 TO 5 40 FOR I=1 TO 5 50 PRINT PAPER C, PAPER C+1, PLOT 0,175-20 +C: DRAW 255.0 NEXT C PLOT 0,175: DRAW 0,-159: 55,0: DRAW 0,159: PLOT 12 75 PLD: DRH: 255,0: DRH: 0,159 80 FOR I=2 90 READ A\$ 90 READ A\$ TO 17 STEP 5 90 READ A\$ 100 PRINT AT I,4;A\$ 110 READ A\$ PRINT AT 1,20; A\$ 130 " GREEN "A" YELLO YELLOW " CYAN WHITE 150 RANDOMIZE 2 OR 0 AND 160 ()U SR COPY

SCREENS DEMO PROGRAM>

10 CLEAR 32298 20 LET copy=32299 30 LOAD "SHADE COPY"CODE copy 40 LOAD ""SCREEN\$

Normat" ""Mode 0: 60 RANDOMIZE 0 OR 0 AND 192 () U SR COPY 70 LPRINT "Mode 1: Inverse" 80 RANDOMIZE 1 OR 0 AND 192 SR copy 192 1 OR Ø AND 192 > U 90 LPRINT / "Mode 2: Shade Cop 100 RANDOMIZE 2 OR 0 AND 192 () U

HEX LOADER PROGRAM>

10 INVERSE 0: CLEAR 32288 20 PRINT AT 21,0; 30 LET start=32289 40 LET length=311 50 LET end=start+length 60 LET o\$="" 70 LET n=start 80 POKE 23692,255: PRINT n;" 90 LET d=0: LET m=n: LET t=0
100 IF m=end THEN GO TO 2000
110 GO SUB 1000: LET b=16#h
120 GO SUB 1000: LET b=b+h
130 POKE m,b: LET t=t+b: LET m=
m+1: LET d=d+1
140 IF d<>8 AND m<>end THEN GO
TO 110
150 TNPUT "Checksum:":cs 150 INPUT "Checksum:"; cs 160 IF cs=t THEN PRINT " = "; cs LET n=m: GO TO 80 170 PRINT #0; FLASH 1; "CHECKSUM



RE-ENTER LINE" 180 BEEP 1,-20 LET L 3689: PRINT AT L.S., AT L=24-PEEK 3689: PRINT AT 1,8,,AT 1,8;: INP UT ;: GO TO 90 1000 POKE 23658,8 1010 LET n\$=INKEY\$: IF n\$=0\$ THE N GO TO 1010 1020 LET 0\$=n\$: LET k=CODE n\$: I F k<32 OR k>96 THEN GO TO 1010 1030 IF k<48 THEN GO TO 1080 1040 IF k<58 THEN LET h=k-48: GO TO 1070 1,8; 1070 k (65 OR k) 70 THEN GO 1080 LET h=k-55 PRINT ns; BEEP .01,10: URN
1080 PRINT INVERSE 1;n\$; CHR\$ 8;
BEEP .5,-10: GO TO 1010
2000 CLS: PRINT "O.K. Saving as
:-""SAVE ""SHADE COPY""CODE ";s
tart;","; tength
2010 PAUSE 1: PAUSE 50
2020 SAVE "SHADE COPY"CODE start , length

HEX DATA>

32289 : 2A635C010F0009ED = 495

(continued on page 197)

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- All four languages can be used interactively with each other, and with the user

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TEXT MODE

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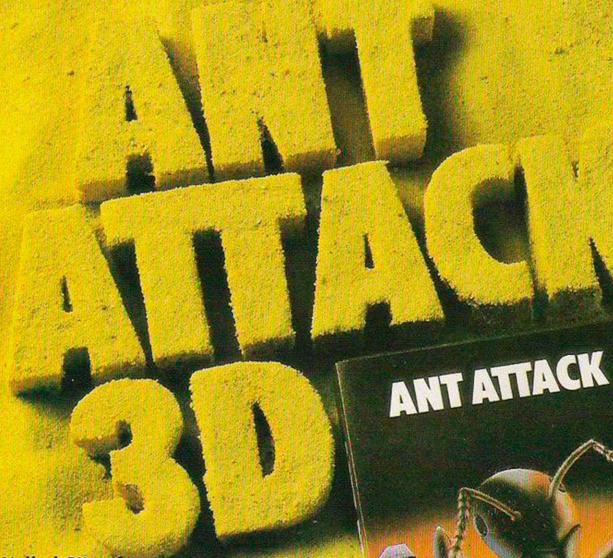
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Then one day He and She arrive to play their games through the wind-swept streets, ousting the Ants from their exclusive occupation.

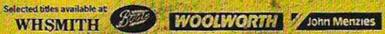
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(continued from page 192)

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32297
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934
                                                                                                                                                     1080
1315
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32337
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32353
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972
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557
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                                            SCE14180CADA0EF3
                                           7AFE5B28BC3E04D3
FBDD21205BEBC5D5
32377
32385
32393
                                         FBDD21205BEBC5D5 = 1273

E501012079B77F20 = 725

030F0F0FE60711F = 557

FF284D3D1EDD2848 = 796

3D1E5528433D16EE = 604

263E3D1144AA2638 = 514

3D1E00283333D1668 = 401

262E53182B21005B = 360

C1C53E0890E60F47 = 920

C1C53E0890E60F47 = 932

E6072805D7340DD23 = 991

2310990D20050620 = 292
32401
32409
32417
 32425
32433
32441
32449
32457
32465
32473
                                                                                                                                        = 1250
= 751
                                                                                                                                                   932
1073
991
32481
32489
32497
                                         DD7200DD7340DD23 = 99
2310990D20050620 = 29
E11891D1EBC1D5C5 = 16
E501200011005BED = 50
11280218A821005B = 31
06207E2F772310FA = 60
189BC1C5DD21205B = 96
CB402804DD21605B = 72
210055430620DD56 = 52
00DD5E20CB492808 = 67
CB9ACB0ACB0BCB0B = 88
7EA2577E2FA3B277 = 10
23DD2310E118BC = 744
                                                                                                                                                   292
32505
32513
                                                                                                                                                   1441
607
                                                                                                                                                   535
375
 3252
32529
32537
32545
                                                                                                                                       = 631
= 946
= 752
= 541
= 671
 32553
32561
32569
32577
32585
32593
                                                                                                                                                   854
                                                                                                                                                    1008
```

New commands

B D Parsons, Saughall, Chester.

VIG-30

THE PROGRAM is a Basic enhancement program which adds new commands to Vic Basic. It is designed to enable users to add their own commands easily following a few simple rules.

The program may be used with any memory configuration and calculates the amount of memory it requires, lowering the "top of memory" pointers accordingly. The machine-code program is then Poked into memory and the Basic program News itself, leaving the New commands ready to be used from within any program typed or loaded into the computer. The new commands may not be used in the direct mode.

Five extra commands are shown included with the program as examples.

Within the Basic program using the new commands, each command must be prefixed with a.

e.g. - @PLOT, @SOUND, etc.

Vic commands.

```
10 PRINT"] SVIC BASIC EXTENSION"
20 PRINT"M B.PARSONS, 1984"
30 PRINT"MOMPLEASE WAIT...WORKING
50 REM RESET MEMTOP .
60 XX=0
70 READAS: IFASC>"END"THENXX=XX+1:GOTO70
90 R=PEEK(55)+256#PEEK(56):R=R-XX:POKE55,R RND255:POKE56,R/256:C=R+1:I=C:TL=0
110 REM LOAD BASIC WEDGE
120 READD:IFD<>-1THENPOKEI,D:I=I+1:TL=TL+D:GOT0120
130 IFTL(>)13892THENPRINT INCORRECT. CHECK LINES 330 TO 440":STOP
140 POKEC+7, (C+15)AND255:POKEC+8, (C+15)/256
150 POKEC+16, (C+21)AND255:POKEC+17, (C+21)/256
160 POKEC+19, (C+28)AND255:POKEC+20, (C+28)/256
POKE 251,177: POKE 252,2: POKE 253,225: POKE 254,2
    REM求章章章章章章章章章
210 REM READ CMD, POKE ROUTINE INTO MEMORY
228
230 READ AS:IFRS="END"THEN 280
240 FORB=1T04:POKE 688+Z#4+B,ASC(MID$(A$,B,1)):NEXT
250 POKE 737+Z#2,I AND 255:POKE 738+Z#2,1/256:Z=Z+1
260 READA: IFAC>-ITHEN POKE I,A: I=I+1:GOT0260
270 GOTO230
280 POKE 682, Z#4+1: REM NO. CMDS.
330 REM WEDGE ROUTINE
340 DATA169,7,133,127,162,5,189,15,27,149,132,202,16,248,96,76,21,27,76,28,27
360 DATR56,233,48,56,233,208,96,201,58,240,12,201,64,208,8,165,123,201,3,16,4
380 DRTR169,64,56,96,162,0,32,115,0,157,161,2,201,44,240,7,232,224,8,208,241
398
400 DRTR24,96,160,0,162,0,140,169,2,177,251,221,161,2,208,9,200,232,224,4,208
420 DATA243,56,176,14,173,169,2,24,105,4,168,204,170,2,48,223,24,96,173,169
448 DRTA2,74,168,177,253,141,171,2,200,177,253,141,172,2,108,171,2,-1
1030 DATAPLOT, 32, 253, 206, 32, 158, 215, 224, 22, 48, 5, 162, 14, 108, 0, 3, 138, 72, 32, 253, 206
1040 DATA158,215,224,22,48,5,162,14,108,0,3,104,168,24,32,240,255,32,253,206,32,
164,202
1850 DRTR76,121,0,-1
1868
1878 DATACOLOUR.32.253,286,32,158,215,224,8,48,3,76,72,210,138,72,32,253,286,32,
1880 DATA224, 16, 48, 4, 104, 76, 72, 210, 138, 72, 32, 253, 206, 32, 158, 215, 224, 16, 48, 5, 104
1890 DRTR104,76,72,210,169,15,45,14,144,141,14,144,138,10,10,10,10,13,14,144,141
1110 DRTR169.248,45,15,144,141,15,144,104,13,15,144,141,15,144,76,121,0,-1
1130 DATADOKE,32,253,206,32,138,205,32,247,215,165,20,133,87,165,21,133,88,32,25
1140 DATA138, 205, 32, 247, 215, 160, 0, 165, 20, 145, 87, 200, 165, 21, 145, 87, 76, 121, 0, -1
1158
1158 DRTRSOUND, 32, 253, 286, 32, 158, 215, 224, 8, 298, 15, 142, 18, 144, 142, 11, 144, 142, 12, 1
44.142.13
1178 DATR144.76.121.0.224.5.48.3.76.72.210.138.72.32.253.206.32.158.215.138.168
1180 DATA104,170,202,152,157,10,144,76,121,0,-1
DRTHYDLUME, 32, 253, 206, 32, 158, 215, 224, 16, 48, 3, 76, 72, 210, 169, 240, 45, 14, 144, 14
1.14,144
 218 DATA138, 13, 14, 144, 141, 14, 144, 76, 121, 0, -1
1990 REM ..............
 BOO DATAEND
```

Below is the syntax for each of the example commands shown. Please note the commaare essential.

@PLOT,X,Y,"STATEMENT" will prin "statement" at character position X along line number Y down from top of screen.

@COLOUR,BO,SC,AUX will set the Vic colours as below:

BO:—value 0-7 sets border colour SC:—value 0-15 sets screen colour AUX:—value 0-15 sets auxiliary colour —

used in multicolour mode.
@DOKE,ADD,NO. will poke a double-byte number i.e., 0-65536 into a two-byte

address.

@SOUND, VOICE, VALUE will cause the voice chosen — 1 to 41 — to sound a note chosen by value — 128 to 255 — see Vic Computer Guide page 135 for value.

The note will continue until a value of less than 128 is chosen or until the volume is turned off — see below. To turn off all sound use the following:

@SOUND,0

@VOLUME,VALUE will set the volume of sound played. Where value is in range — 0-off to 15-maximum.

Machine-code programs supporting commands must be relocatable i.e., they must work when poked into any memory location.

The name of the command must be the first data statement, being a maximum of eight letters and a minimum of four — note only the first four letters are checked so don't use any commands with the same first four letters.

Each machine-code routine must end with — JMP-£0079 i.e., DATA 76,121,0,-1. The -1 being used by the Basic wedge program to detect the end of the routine.

Program breakdown.

LINES 50-90 Calculate approximately how many bytes are required by the machine-code routines, lower top of memory pointers accordingly and calculate start address.

LINES 100-160 Poke M/C wedge program into memory from start address.

LINES 140-160 Modify M/C program according to start address.

LINES 180-190 Set up pointers in zero page for command list and start address.

LINES 200-280 Read the command names and place these in a list starting at address 737, then poke the routine into memory following the wedge program. Also calculate the number of commands and store.

LINES 290-310 Run the wedge program and New the Basic program. The number shown on the screen is the top of memory pointer + 1.

LINES 320-440 Contain the M/C wedge

LINES 1000-1210 Contain sample Basic extension routines. To enter extra commands place your own routines after line 1210 and before line 1990.

Colour mix

Jason Rider, Butterton, Staffordshire.



As the Dragon can only have four colours when working in the high-resolution modes I have made this program so that the four col(continued on next page)

(continued from previous page)

ours of Mode 3 can be mixed to make a further 71 colours in each colour mode — green and buff.

When loaded using CLoad"colour" the computer first asks you to choose the colour resolution — green or buff.

Next you are asked how many colours you would like to mix — either two or three. After

this you are asked where abouts you want to start your colouring. You enter the coordinates of the top left-hand corner of the area to be coloured. Now the bottom right hand set of co-ordinates are to be entered.

Lastly, you have to enter the colours which you want to mix — the same colours but in a different order will give a different shade of colour.

Now your colour is painted on the screen

where you wanted it.

The following keys can now be pressed:

B change the mode and colour to buff. G change the mode and colour to green.

C will let you paint another area without clearing the other painted areas out of memory.

A will let you have another go — all previous painted areas will be cleared out of memory.

```
10 PMODE 3:SCREEN 1,1:PCLS
20 REM COLOUR MIX BY JASON RIDER
                                                                     300 IF R=3 THEN INPUT D
                                                                     310 GOTO 430
                                                                     320 CLS
30 Y=-1
40 CLS:PRINT:PRINT"
                            DRAGON COLOUR MIX"
                                                                     330 PRINT
                                                                     340 PRINT" CHOOSE ";R;" COLOURS TO MIX"
50 PRINT: PRINT" - CHOOSE COLOUR RESOLUTION .....
60 PRINT
                                                                     350 PRINT
                                                                     360 PRINT"1.BUFF"
70 PRINT"1. GREEN. "
80 PRINT"2. BUFF. "
                                                                     370 PRINT"2.CYAN"
                                                                     380 PRINT"3, MAGENTA"
90 INPUT A
                                                                     390 PRINT"4. ORANGE"
100 PRINT: PRINT" HOW MANY COLOURS (2/3)"
                                                                     400 INPUT B
110 INPUT &
120 IF RC23 AND RC>2 THEN 100 130 PRINT: PRINT" WHERE DO YOU WANT THE COLOURING TO START"
                                                                     410 INPUT C
                                                                     420 IF R=3 THEN INPUT D
                                                                     430 IF A=1 THEN PMODE 3:SCREEN 1,0
140 INPUT G: INPUT H
                                                                     440 IF A=2 THEN PMODE 3:SCREEN 1,1
150 PRINT: PRINT" WHERE DO YOU WANT THE COLOURING TO FINISH"
                                                                     450 FOR J=H TO M
160 INPUT N: INPUT M
                                                                     460 Y=Y+1
170 IF A=1 THEN GOTO 200
                                                                     470 IF Y=R THEN Y=0
180 IF A=2 THEN GOTO 320
                                                                     480 FOR K=G+Y TO N STEP 4
190 GOTO 90
                                                                     490 PSET(K,J,B):PSET(K+1,J,C):IF R=3 THEN PSET(K+2,J,D)
200 CLS
                                                                     500 NEXT K
210 PRINT
220 PRINT" CHOOSE ";R;" COLOURS TO MIX"
                                                                     510 NEXT J
                                                                     520 A$=INKEY$: IF A$=""THEN 520
230 PRINT
240 PRINT"1. GREEN"
                                                                     530 IF A$="8" THEN SCREEN 1,1
250 PRINT"2. YELLOW"
                                                                     540 IF A$="G" THEN SCREEN 1,0
260 PRINT"3.BLUE"
                                                                     550 IF A$="A" THEN RUN
270 PRINT"4. RED"
                                                                     560 IF A$="C" THEN 20
                                                                     570 GOTO 520
280 INPUT B
290 INPUT C
```

Windows

Richard Shergold, Selsey, West Sussex.



THIS PROGRAM for the QL starts at line 32500 so that it can be put at the end of a program and called when needed. It allows QL owners

to design their own windows using cursor control and text input. This puts an end to any trial and error methods of window design that many QL users are used to. To operate the program type Windows.

After entering the window number you require you may move the window around by using the cursor keys — Ctrl+cursor key gives extra zip. You can also adjust the size of your window by using the Alt key with the cursor keys. To see exactly how big the window is with regards to character size you may enter text by pressing F1.

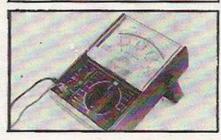
F2 will allow you to change window numbers and Esc will allow you to return to your original program and use your designed window.

```
32500 DEFine PROCedure windows
32501 PAPER 1:INK 7:PAPER£0,0:INK£0,7
32502 CLS:CLS£0
32503 INPUT£0, "WIDTH? : ", wid: INPUT£0, "HEIGHT? : ", height
32504 a=100:b=100
32505 INPUT£0, "Window no : ", win
32506 IF wink3 THEN GO TO 32505
32507 CLS£0
32508 OPEN£win,scr
32509 IF wid+a>480 THEN LET a=480-wid
32510 IF a<0 THEN LET a=0
32511 IF b<16 THEN LET b=16
32512 IF b+height>216 THEN b=216-height
32513 WINDOWEwin, wid, height, a, b
32514 ATE0,0,0:PRINTE0;"
                                ";:INK£0,7:PRINT£0;"Window£";win;" ";wid;" ";heigh
t; " "; a; " "; b; " ": INK£0, 4: PRINT£0: PRINT£0\"CURSORS=MOYE
                                                               F2=CHANGE
                                                                             ALT=SIZ
E"\"CTRL=ZIP
                     F1=TEXT
                                   ESC=QUIT"
32515 BORDER£win, 1,7
                                        32525 =209:height=height+1
32516 z=CODE(INKEY#(-1))
                                        32526 =217:height=height-1
32517 SELect ON z
                                        32027 =236 :Windows
32518 =200 : a=a+1
                                        32528 =202:a=a+10
32519 =232:text
                                        32529 =194:a=a-10
32520 =192 : a=a-1
                                        32530 =210:b=b-10
                                        32531 =218:b=b+10
32521 =208:b=b-1
                                        32532 =27:END DEFine windows
32522 =216:b=b+1
32523 =201:wid=wid+1
                                        32533 END SELect
32524 =193:wid=wid-1
                                        32534 CLS£2
                                                                     (continued on page 201)
```

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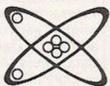
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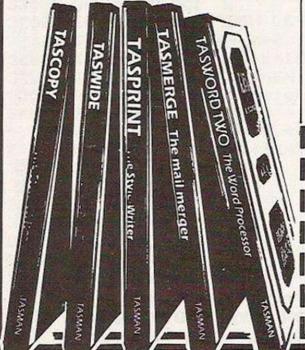
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(continued from page 198)

32535 GO TO 32509

32536 DEFine PROCedure text

32537 CURSOR£win,0,0

32538 CLS£0:INPUT£0, "ENTER TEXT ";us:PRINT £win,us

32539 PAUSE 200:CLS£0

32540 END DEFine

Find

Alan Wagstaff, Skeeby, Richmond, North Yorkshire.

LINEFIND locates any specified string in a Basic program and prints the numbers of all Basic keywoards. It responds to the command *LINE str

The listed program points the vector UseRV at &C00 and assembles the machine code there. To place it at a different address, change lines 150 and 1020.

If your micro is equipped with Basic 1 most are — then you can save yourself a lot of 510JSR&98F9

then omit lines 1040 to 1440 inclusive. If you aren't sure which Basic you have then enter PRINT?&8015

If the answer is 49 then you have Basic 1.

Having entered the listing, Save it then Run it. The code can now be tested by entering *LINE LDA

The numbers of all lines containing LDA should appear on the screen. If not, check your listing. Pressing Break at any time will disconnect the code. Reconnect it by entering the contents of line 1020 as a direct command. It can be useful to put this command on to a user defined key.

As long as the machine code is undisturbed, and the vector is pointing at it, the

*LINE str

command can be used with any Basic program

	490LDA (P) .Y	get line no. 1sb	970.M	
INFETAID			9803	
CIMELIAD 444	5100PT FNCODE	print line no.	990NEXT	
OCTAFE 1994	520JMP q	goto q	1000FORF%=M TO	M+9:READ ?F%:NEXT
00 IMPF 1784	530.d		1010DATA1,10,1	00,232,16,0,0,0,3,3
	540STA ST	store str char	10207&200=0: 7&	201=&C
command *LINE Str			1030END	
	560TAY	prog pointer	1040DEF FNCODE	
	570.e		1050COPT PASS%	
		get prog byte	1060LDY#4	
	590CMP#13	end of prog line ?	1070.h	
	600BEQ q	if so, goto g	10BOLDA#0	
	610INY	step pointer on	1090STA&3F,Y	
Too exerc	620CMP ST	prog char=str char ?	1100SEC	
IUZ SIEPZ	630BED f	if so, goto f	1110.i	
	640LDA F	get flag	1120LDA&2A	get line no. 1sb
	650BEQ m	if down, goto m	1130SBC M,Y	
	660DEY	step pointer back	1140STA T	
address in 5/5+1	670LDA#0		1150LDA&2B	get line no. msb
	680STA F	pull flag down	1160SBC M+5,Y	
proq pointer=3	690.m		1170BCC j	
	700TYA		1180STA&2B	
	710PHA	store prog pointer	1190LDA T	
	720LDY@0		1200STA&2A	convert
	730STY PR	reset str pointer	1210LDA#0	line
	740LDA(S),Y	get 1st str char	1220ADC&3F,Y	number
page+1 into P/P+1	750STA ST	and store it	1230STA&3F,Y	into
	760PLA		1240SEC	decimal
	770TAY	retrieve prog pointer	1250BNE i	
	790BNE e	goto e	1260.j	
	790.f		1270DEY	
	BOOSTA F	put flag up	1280BPL h	
	B10TYA		1290LDY#5	
	820TAX	store prog pointer	1300.k	
. and finish	B30INC PR	step str pointer on	1310DEY	
	840JMP c	goto c	1320BEQ 1	
	850.g		1330LDA&3F,Y	
	860LDX#3	reset prog pointer	1340BEQ k	
The state of the s	870LDA#O		1350.1	
and store it	BBOSTA PR	reset str pointer	1360LDA&3F,Y	
	890PLA	get line length	1370DRA#&30	
	900CLC		1380JSR&FFEE	and print it
	910ADC P		1390DEY	
The Control of the Co	920STA P		1400BPL 1	
1+ not, goto d	930LDA#0		1410LDA#32	followed by
	940ADC P+1	add to prog address	1420JSR&FFEE	a space
get line no. msb	950STA P+1	for next line	14303	
	960JMP a	goto a	1440=PASS%	
	STAFF 1984 command *LINE str TO2 STEP2 store string address in S/S+1 proq pointer=3 pull flaq down page+1 into P/P+1 get prog byte end of program ? if not, goto b else newline and finish get line length and store it string pointer get string char end of string ? if not, goto d qet line no. msb	### SOOSTA&2A	SOUSTAR2A	SOOSTAK2A SIOOPT FNCODE STORT STORT STORT FNCODE STORT STORT STORT FNCODE STORT STORT

Sprite control

Wartin Wicks, Southampton. CBM-64

THIS SIMPLE BASIC program solves the promem of linking together a simple sprite proand a read-joystick routine.

The program also incorporates several user functions which allows the user to alter the screen image. Here are the keys and their functions:

Key Function

- Puts sprite in front of data
 - Puts sprite behind data
- Puts sprite into hi-res mode
- Puts sprite into multi-colour mode M
- Expands sprite in X Direction
- Expands sprite in Y Direction U
- Unexpands sprite in Y direction V Unexpands sprite in X direction
- Turns sprite off
- Turns sprite on

(continued on page 204)

- 0 CLR
- 1 A=5:B=5:C=1
- 2 X=100:Y=100
- 5 POKE650, PEEK (650) OR128
- 10 V=53248

- 11 POKEV+39,7
- 20 POKEV+21,1
- 30 POKEY+32, B
- 40 POKEV+33,C

(listing continued on page 204)

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(continued from page 201)

Changes screen background colour

Q Changes screen border colour

Changes sprite colour

R Jumps to system cold start W Clears the screen

E **Ends Program**

Changes sprite multi-colour 0

Changes sprite multi-colour 1

To get the full effect of the sprite priority, List the program before running.

I have also included four different sets of sprite data which have been saved after the initial program. These are to show the full effect of the sprite multi-colour because you cannot see the multi colour on a simple square sprite. The sprite data should be inserted at about line 5000, at the end of the initial program, and the following alteration should be made:

70 FOR N = 0 to 62; Read Q; POKE 12288 + N,Q:NEXT

When you use the multi-colour change function, the border and background colours must be altered when the multi-colour change

The actual program uses the joystick in port 1 to move the sprite, and the user functions may only be used when the sprite is in a stationary position.

Finally, here is a program listing description:

clears variables. 0

1-2 sets up variables.

puts a repeat on all keys. 5

10 sets up Vic chip.

11 sets up sprite 0 colour.

turns on sprite 0. 20

30-50 sets up character border and background colours.

60 Pokes sprite 0 pixel data.

positions sprite 0 pixel data. 70 95 positions sprite 0 on screen.

96-99 sets up screen limit for sprite. 130-200 sets up read joystick routine.

300-390 user functions. 1000 returns to 95.

sprite data should be inserted here and the given changes made.

(listing continued from page 201)

50 POKE646,5

60 POKE2040,192

70 FORN=0T062:POKE12288+N,255:NEXT

95 POKEV,X:POKEV+1,Y

96 IFYC50THENY=Y+5

97 IFY>230THENY=Y-5

98 IFX<25THENX=X+5

99 IFX>250THENX=X-5

130 Q=PEEK(56321)

140 IFQ=254THENY=Y-5

150 IFQ=246THENY=Y-5:X=X+5

160 IFQ=247THENX=X+5

170 IFQ=245THENX=X+5:Y=Y+5

180 IFQ=253THENY=Y+5

190 IFQ=249THENX=X-5:Y=Y+5

195 IFQ=251THENX=X-5

200 IFQ=250THENX=X-5:Y=Y-5

300 REM**USER FUMCTIONS**

310 GETA\$

320 IFA\$="I"THENPOKEV+27,0

330 IFA≸="M"THENPOKEV+28,1

331 IFA≸≈"A"THENPOKEV+28,1:POKEV+37,C+1

333 IFA\$≈"H"THENPOKEV+28,0

335 IFA\$="E"THENEND

340 IFA\$="X"THENPOKE53277,PEEK(53277)OR(210)

345 IFA\$≈"Y"THENPOKE53271,PEEK(53271)OR(210)

350 IFA\$="U"THENPOKE53271,PEEK(53271)AND(255-2↑0)

352 IFA\$="V"THENPOKE53277,PEEK(53277)AND(255-2↑0)

355 IFA≸="O"THENPOKE53269,PEEK(53269)AND(255-2↑0)

360 IFA≸="S"THENPOKE53269,PEEK(53269)OR(210)

365 IFA\$="P"THENC=C+1:POKE53281,C+1

370 IFA\$≃"Q"THENB=B+1:POKE53280,B+1

375 IFA\$="C"THENA=A+1:POKEV+39,A

385 IFA\$="W"THENPRINT"∭"

390 IFA\$="R"THENSYS64738

1000 GOTO95

Proton pursuit

Steve Fletcher, Hallowers, Dronfield.



THIS PROGRAM is a very fast pursuit game for any Spectrum. The idea behind the game is original and in it you take on the roll of the nucleus of an atom who is free to move within the atom but must avoid the stationary electrons which are randomly scattered about.

The protons of the atom are attracted to the nucleus and therefore pursue you whereever you move. If a proton catches the nucleus the game ends, but to avoid being caught you must lure the protons into the stationary electrons. When all the protons have been eliminated you start a new atom with different protons. The game allows you to have 3 to 9 protons chasing you at a speed of 1-5 giving a possible of 30 different atoms!

A high score is kept which is initially 500.

Control is up, down, left and right by the keys Q,A,O,P respectively. To set up the game type in listing 1 and save it on to tape using SAVE "PROTON" LINE 220

Now type in listing 2 and run it. If any error is found in the data the program will tell you which line needs changing. When the data is all poked in correctly, save it with:

SAVE "PROTONCODE" CODE 27000,958 The game is now ready to play. To play i rewind the cassette and type Load" "

```
Listing 1.
         20 REM +****
25 LET sc=0:
$="Steve"
                                                       LET hi =500: LET a
       "Steve"
30 RANDOMIZE: PAPER 6: BORDER
5: INK 0: CLS
40 PRINT AT 10,2; "Enter number
of Protons(3-9)"
50 LET d$=INKEY$: IF CODE d$>5
AND CODE d$<58 THEN GO TO 70
60 GO TO 50
TO LET a=CODE d$-48: FOR f=1 T
(a*2) STEP 2: POKE f+28999.INT
70 LET a=CODE d$-48: FOR f=1 T
0 'a*2) STEP 2: POKE f+28999,INT
(RND*19)+1: POKE f+29000,INT (R
ND*29)+1: NEXT f
80 CLS: PRINT AT 10,8;"Enter
Speed (1-5)"
speed (1-5)

90 LET d$=INKEY$: IF CODE d$>4

8 AND CODE d$<54 THEN LET b=CODE

d$-48: GO TO 110

100 GO TO 90

110 FOR (=1 TO (8*2)+b STEP 2:

POKE f+29019, INT (RND*19)+1: POK
```

```
E /+29020, INT (RND*29)+1:
120 PAPER 0: INK 7: BORD
LS
                                                                                    BORDER 2:
    5
130 POKE 27221,b
135 POKE 23659,0: PRINT RT 22,3
; INK 7; BRIGHT 1; PAPER 2;" 5t
ve Fletcher © 26/5/84 PROTON"
140 RANDOMIZE USR 27741
    150 POKE 23559,2
160 IF PEEK 23500(>255 THEN LET
sc=s(+(30+a)+10-(20+b): GO TO 3
                    PRINT AT 10,11; FLASH
165 PRINT AT 10,11; FLASH 1; S
CORE ";SC;"
166 FOR !=0 TO 400: NEXT !
170 IF SCX=H: THEN GO TO 190
180 LET h:=SC: PAPER S: BORDER
4: INK 7: CLS PRINT AT 8,6; FL
ASH 1; PAPER 2; * A NEW HIGH SCO
RE * PRINT AT 12,5; PAPER 3; E
190 PAPER 3: BORDER 2: INK 7: C
LS: RANDOMIZE USR 27150: PRINT
AT 8,8; "Today's highest ";AT 11,8;a$; ";hi
```

```
200 FOR (=0 TO 300: LET sc=0; N
EXT (
210 PAUSE 0: SO TO 30
220 LOAD ""CODE : RUN
 Listing 2.
         1 REM ** PROTON LISTING 2 **
2 DEF FN x (as) =16+(CODE as-48
-(39 AND as(1))"9"))+CODE as(2)-
48-(39 AND as(2))"9")
3 LET a=27000
4 FOR (=10 TO 150 STEP 10: RE
AD as: LET t=VAL as( TO 4): LET
AD a$: LET t=VAL a$( TO 4): LET

a$=a$(5 TO)

5 FOR b=0 TO 63

6 LET z=FN x(a$(b*2+1 TO b*2+2)): POKE a,z: LET a=a+1: LET t=

t-z: NEXT b: IF NOT t THEN NEXT

f: PRINT "Finished": STOP

7 PRINT "Error in time": 5
      10 DATA
 57e fe 10200511 f5591815 fe 81200511 f
                                          (continued on page 207)
```

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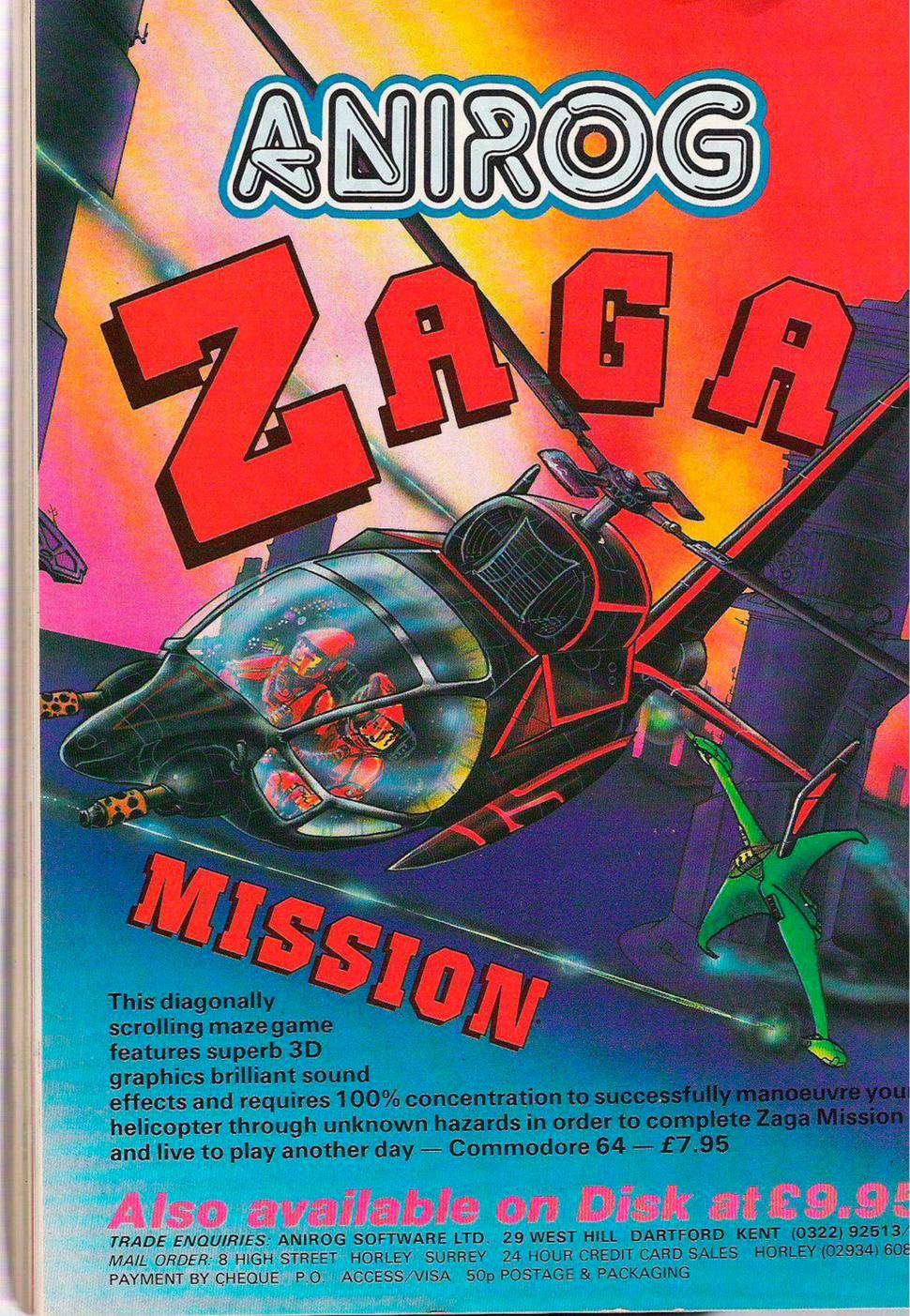
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continued from page 204)

110 DATA "59978 f5 ccd2b6 ce5cd5a6 ae1d5e5cd4a6ce1d13a556 f fe6320171 13075ed53585a3e07328 f5 ce5cd5a6ae 13663a f32556 f23231866e55e2356210 05843d511200019" 1200 DATA "739310 fdd15a1600197ee 1fe05c03e6332556 fc9563a606dbac023583a618dbac03eff32546 fc9af32546 f110a0 fed53606dcdcb6a0684c5cd006 bcda56cc110 f6126566606010 fec11 1300 DATA "7177556a3c47c5cd086bcda56cc13a546 ffeff28362148717efe0 02857 fe632004232318 f310d fcdad69cda66bcda66cc13a546 ffeff28362148717efe0 02857 fe632004232318 f310d fcdad69cda66bcd0602c5066025660010 fec11 0f8c110 f2c92148" 1400 DATA "705571af0664772310 fcc921606d22566a21266d22586acd5a6a0 603c50600c506000506003e3ad3fe3edfd3fe1 0f6c100 f0c1100 ea18 cc21b86 f22566a1 16669ed53565acd" 1500 DATA "7229 fc6c181d110101ed5 3b66fd5cd5a6ad1447afe1f2802218eff1 6011c7bfe15c010e60614c5cdad69c11 0f9212e6d22586acdfc6c18a3003c7effffffff7e3c0000"

Paint routine

S Linnik, Nuneaton, Warwickshire.

2,176,1876

25,133,1659

4.1154

.12.1544

.196,1373

,31,1234

133,1138

13,1329

0303

THIS MACHINE-CODE paint routine is for the Oric 1 or Atmos 16 or 48K. It will fill any outline given a point inside it, in Ink or Paper.

The initial point is set from Basic using the Curset, Curmov, or Draw instructions. This is followed by a Call to the routine.

Whether the outline is "painted" in Ink or Paper depends on the value of a memory loca-

tion whose address is printed in line 70 of the machine-code loader. If this location contains a 0 then an Ink paint will result, if 255 then Paper.

The FB value of the above graphic instructions can be used to set this location. A 0 will set it to 0, and a 1 to 255. This means that the type of paint used will be opposite to that of the point plotted. The address can also be Poked with the desired value in which case the FB value must be 2 or 3. These values leave the location unaffected.

Screen attributes are not altered by painting and are treated as a row of six set points.

.1416

,2565

,243,96,2127

The routine can be relocated in memory by altering the value of the variable HI in line 20. This is the highest address used by the machine-code routine. The value given will place the program at the top of user memory in Hires mode on the 48K machine. For 16K machines the values in lines 10 and 20 should be altered as shown in the listing.

The program uses a stack whose size is set by variable ST in line 30. With the value given, the program uses 1,328 bytes of memory. 16K machine owners might like to save memory by reducing this value — using a value of 85 will save 0.5K bytes.

```
10 SI=0
               'for 16K machines use SI=32768
 20 HI=38900
               'for 16K machines use HI=6132
 30 ST=255
               stack size (255 is maximum)
 35 :
 40 CA=HI-510:PRINT "call program with CALL "; CA:PRINT
 50 PRINT "to CSAVE program as data block use
                                                   addre
sses A";
 60 PRINT HEX$(CA-23); ",E"; HEX$(HI)
 70 PRINT: PRINT "POKE address for INK/PAPER paint="; CA
-23
 75 :
 BO PRINT: PRINT "checking data..."
 90 FOR LI=0 TO 37:CS=0:FOR BY=0 TO 13
 100 READ V: CS=CS+V: NEXT BY
 110 READ CV: IF CV<256 THEN GOTO 130
 120 TF CS=CV THEN NEXT LI: BOTO 140
 130 PRINT "checksum error in line ";1010+10*LI:END
 140 PRINT "checksum ok... type L to load program"
 150 GET A$: IF A$<>"L" THEN END
 155 :
 160 RESTORE: PRINT: PRINT "loading ... "
 170 FOR LI=CA-7 TO CA+497 STEP 14:FOR BY=0 TO 13
 180 READ V: POKE LI+BY, V
 190 NEXT BY: READ V: NEXT LI
 200 FOR BY=1 TO 12: READ V: A=CA+V
 210 DOKE A, DEEK (A) +HI-38900: NEXT BY
 220 DOKE CA-8, CA-42-ST: DOKE CA-10, CA-42-2*ST: DOKE CA-
12, CA-42-3*ST
 230 DOKE CA-14,48920-SI:DOKE CA-16,41176-SI:DOKE CA-1
B,40920-SI
 240 DOKE CA-23,256*ST
 250 PRINT "HIMEM set to ";HI-560-3*ST:HIMEM (HI-560-3
+ST): END
 255 :
 1010 DATA 1,32,16,8,4,2,1,120,32,229,151,32,2,150,780
 1020 DATA 32,229,151,88,96,173,229,2,201,2,176,6,73,2
55,1713
 1030 DATA 170,232,134,20,173,25,2,162,255,56,233,6,23
```

1040 DATA 251,105,6,168,185,240,149,133,1,138,24,101,

1050 DATA 2,169,0,101,26,168,174,26,2,240,13,169,40,2

1060 DATA 101,2,133,2,144,1,200,202,208,243,162,0,134

1070 DATA 134,13,134,19,166,2,165,1,32,184,150,164,13

1080 DATA 12,208,1,96,177,33,133,10,177,35,133,11,177

1090 DATA 133,9,41,128,133,15,16,26,165,10,56,233,40,

1100 DATA 10,176,2,198,11,200,196,21,208,2,160,0,132,

1110 DATA 6,9,70,9,16,6,177,31,9,128,145,31,162,0,799

150,165,1892 1130 DATA 14,208,16,165,6,240,23,133,11,165,5,133,10, 165,1294 1140 DATA 4,133,9,16,221,164,6,240,7,165,4,166,5,32,1 172 1150 DATA 184,150,184,80,150,132,16,164,12,145,31,138 ,145,33,1564 1160 DATA 165,16,145,35,200,196,21,208,2,160,0,132,12 ,196,1488 1170 DATA 13,208,2,104,104,96,134,17,162,0,134,18,134 ,7,1133 1180 DATA 134,8,165,15,240,4,230,7,208,2,230,8,165,11 ,1427 1190 DATA 133,3,165,10,133,2,165,9,133,1,165,3,197,28 ,1147 1200 DATA 176,7,166,2,228,27,176,1,96,197,30,144,7,16 6,1423 1210 DATA 2,228,29,144,1,96,160,40,177,2,168,69,20,37 ,1173 1220 DATA 1,240,7,165,19,208,2,104,104,96,152,41,96,2 40,1475 1230 DATA 250,162,0,160,0,177,2,168,41,96,208,4,169,1 ,1438 1240 DATA 208,12,152,69,20,37,1,208,5,164,7,240,1,232 ,1356 1250 DATA 133,7,160,80,177,2,168,41,96,208,4,169,1,20 8,1454 1260 DATA 13,152,69,20,37,1,208,6,164,8,240,2,232,232 ,1384 1270 DATA 133,8,138,240,74,224,3,240,51,165,2,164,15, 240,1697 1280 DATA 14,224,2,240,41,56,233,40,170,165,3,233,0,2 08,1629 1290 DATA 12,224,1,240,27,24,105,40,170,165,3,105,0,1 68,1284 1300 DATA 165,6,240,25,165,4,197,1,208,8,228,5,208,4, 1464 1310 DATA 196,6,240,19,165,1,166,2,164,3,230,14,76,18 4.1466 1320 DATA 150,165,1,133,4,134,5,132,6,165,18,208,8,23 0,1359 1330 DATA 18,165,17,133,19,16,8,160,40,165,1,81,2,145 ,970 1340 DATA 2,165,1,166,17,48,13,74,144,25,169,32,230,2 ,1088 1350 DATA 208,19,230,3,208,15,10,201,33,144,10,169,1, 166.1417 1360 DATA 2,208,2,198,3,198,2,133,1,76,245,150,162,36

1370 DATA 181,0,188,203,149,157,203,149,148,0,202,208

1380 DATA 2,5,8,40,86,153,158,189,426,493,500,503,1,1

1120 DATA 134,6,134,14,232,32,213,150,162,255,32,213,

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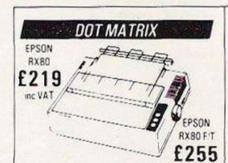
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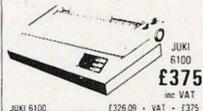
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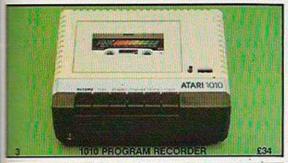
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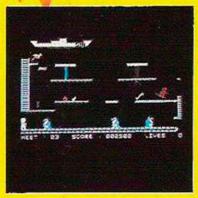
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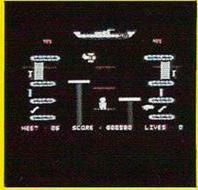


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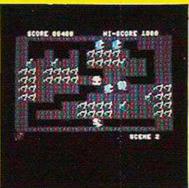


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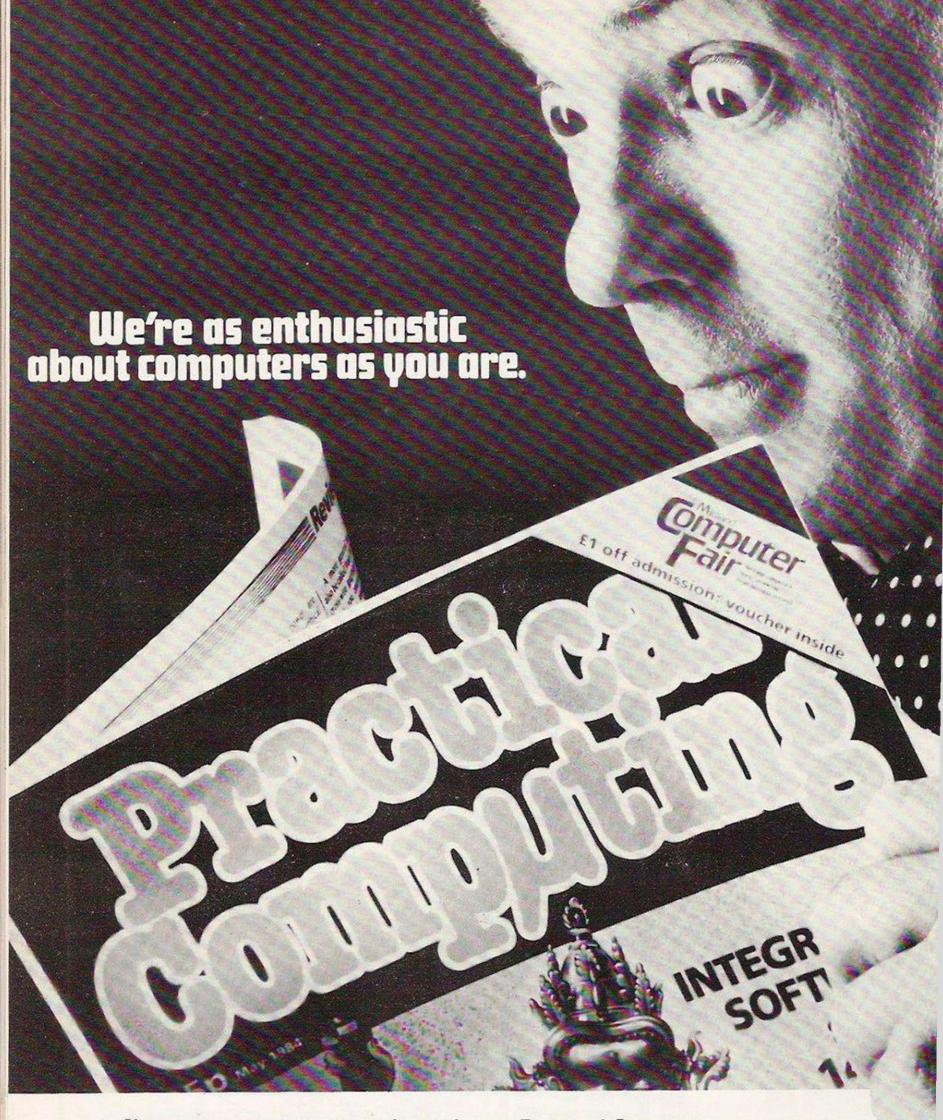
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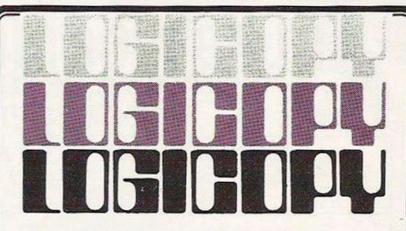
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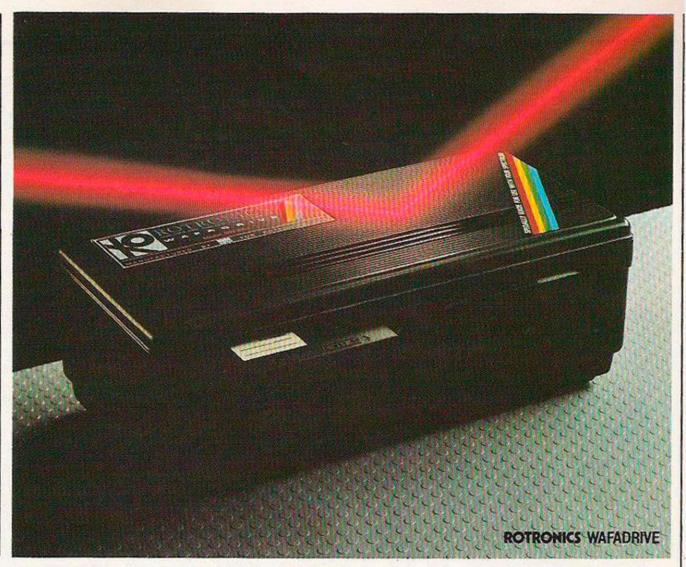
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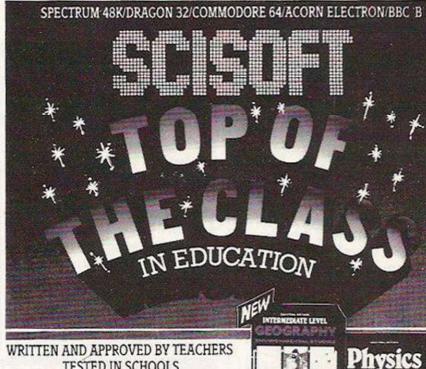
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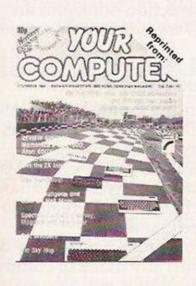
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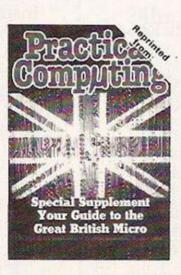
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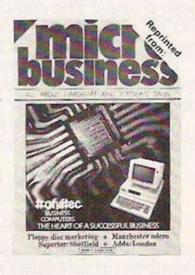
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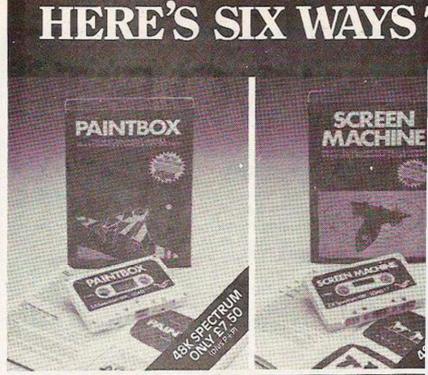
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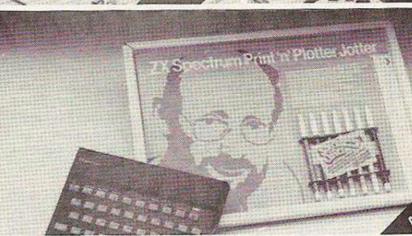
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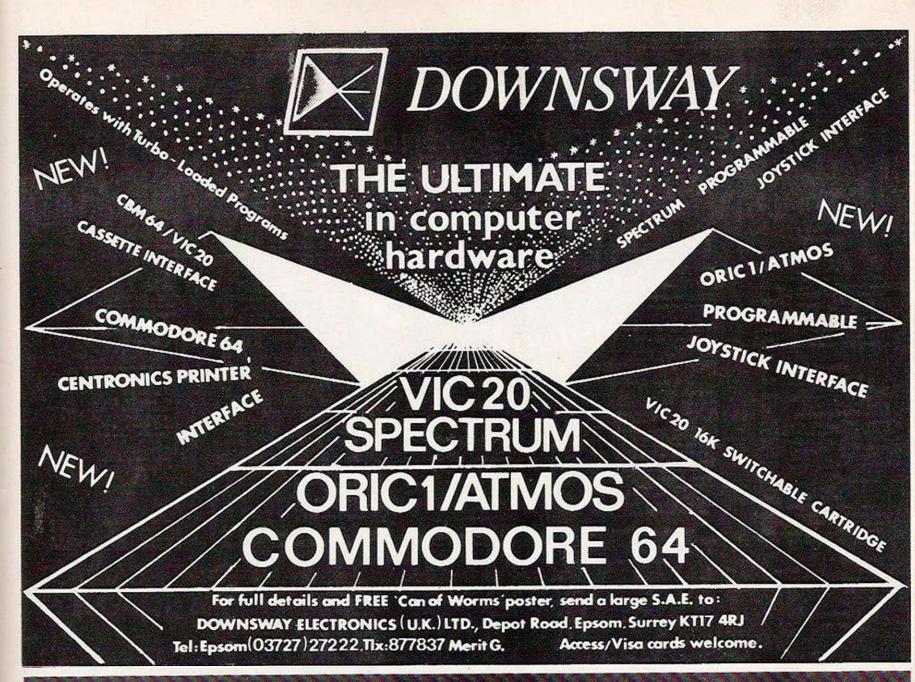


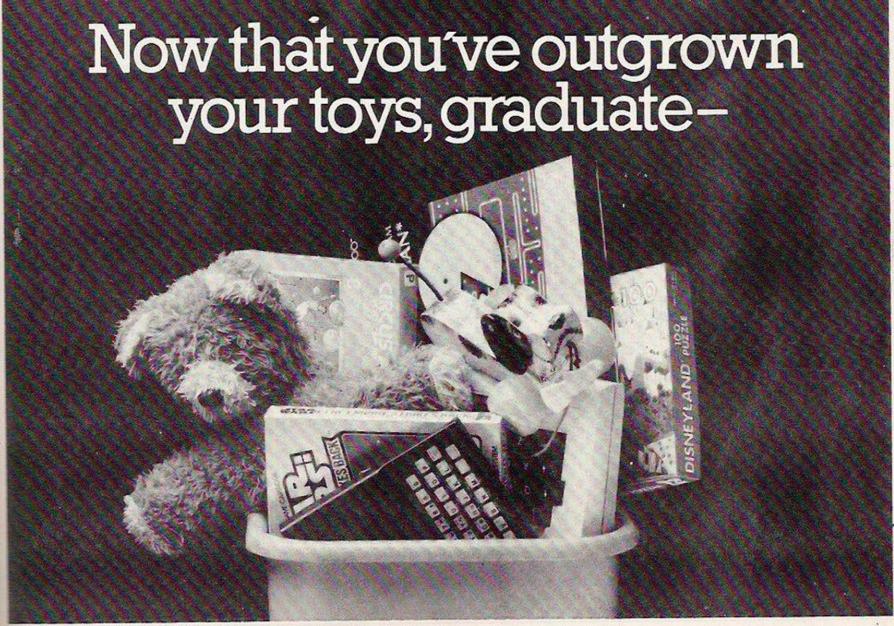
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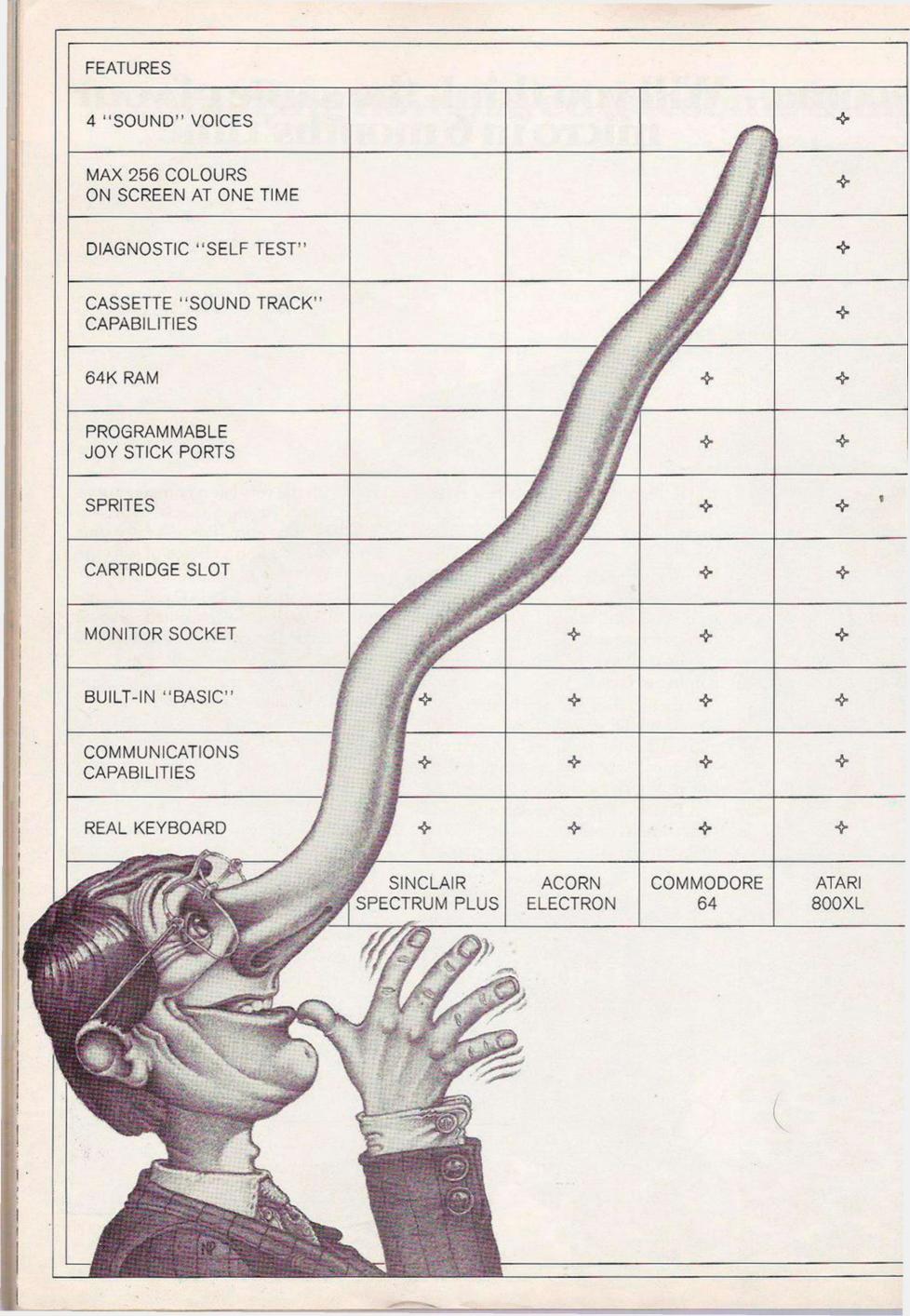
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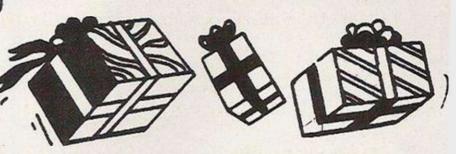
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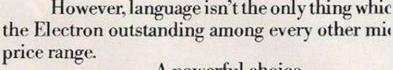
With a hint of pride, they'll also tell you that they're fluent in the computer language which Acorn developed for the BBC Micro. It's called BBC Basic.

And if you ask their advice on choosing a home computer for around £200, they're likely to tell you that there's really only one sensible choice.

The £199 Acorn Electron.

Like its £399 stablemate, but unlike any other micro, the Electron speaks BBC Basic. Which means that children can easily carry on with their computer studies at home.

And their parents can quickly start catching up, because BBC Basic is such a simple language to learn.



A powerful choice.

The Electron is a 64K microcomputer whi 32K of RAM, combined with another 32K ROM.

This simply means that it has more power to people ever need from a home computer.

Nevertheless, it has been designed to help y the fullest use of its power.

For example, its graphics have the highest r ution of any home computer bar none.

This is because Acorn specially designed t chip that controls the graphics. And it's among t most advanced chips of its kind.

Indeed, it delivers twic as many characters across the screen as the Electron's neare rival.

It expands into a syste

With the Electron, evnewcomers have been surp how quickly they can find into the complex world of co

Where many compu keyboards which are conf clumsy to operate, it has a just like an ordinary elect typewriter's.

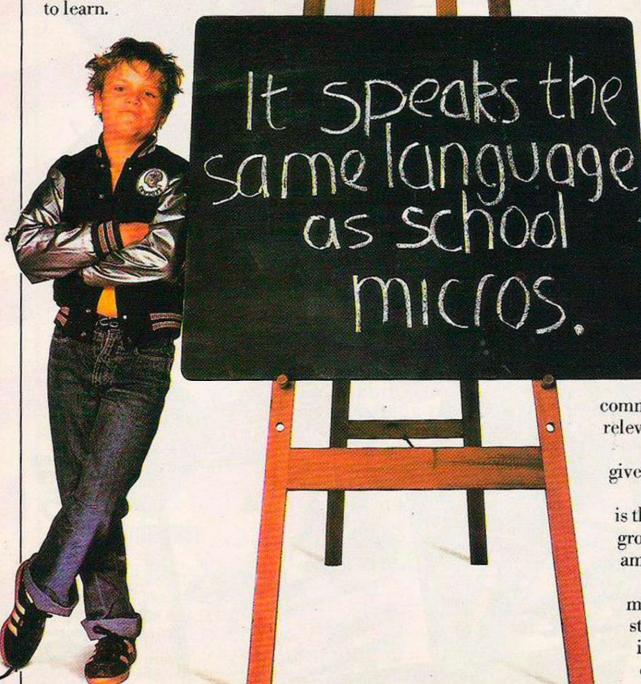
And for issuing ma mands, there are single e Instead of literally spelli

command, letter by letter, you just pu relevant key and it's issued.

There's also a built-in loudspea gives high quality sound.

And what is perhaps most excit is that the Electron has the capacity grow with your knowledge and ambition.

With Acorn's Plus I expansi module, it can link up with a prin sticks and fast-load cartridge soft including View and Viewsheet cessing and spread sheet progra



With the Plus 3 module, which will soon be available, you'll have a disc drive system and will be able to enjoy all the speed and convenience of 3.5 inch discs.

But let's not get carried away too quickly. You can start using and enjoying your Electron as soon as you get it home.

All you need is your television set and a cassette recorder.

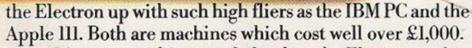
The speed of a business micro.

Some home computers
respond pretty slowly to your
commands. After you've
pressed the keys, they leave
you twiddling your

thumbs for more than a mere few seconds.

The plodders, however, are a very long way behind the Electron.

In fact, on processing speed, a recent bench test survey ranked



It's an astonishing accolade when the Electron makes no greater claim than to be a micro which is designed to become part of the family.

Your starter for free.

With your Electron, you'll receive a free introductory cassette.

It will give you a taste of the exceptional colour graphics. It will show you how the Electron can play and notate music.



And when it's given you some new ideas about home accounting, it will challenge yo to a few games and even spend few seconds doing your whole family's biorhythms for you.

But remember, although in holds 15 programs, the cassette will only give you a glimpse of the Electron's full potential.

Because the potential is as infinite as your own imagination

No shortage of software.

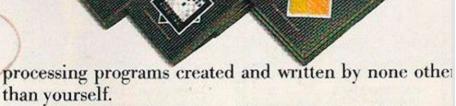
Although the Electron is still a relative newcomer to the market, the range of software available for it is considerable.

Besides plenty of games, there are many educational programs for children of all ages, from playschoot to A Level.

There's a great deal to keep adults occupied, too. From money management to helpful domestic

programs, even a range of foreign language programs, teaching the basics of French, German, Italian and Spanish.

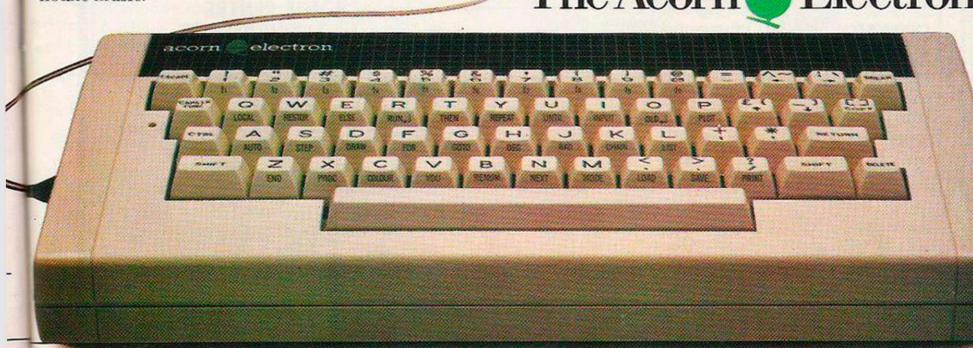
And of course, with its simplicity and flexibility, the Electron could soon be



You can find the Acorn Electron with its full complement of accessories and software at local Acorn dealers and major high street stores.

For the address of your nearest supplier, ring 0933 79300.





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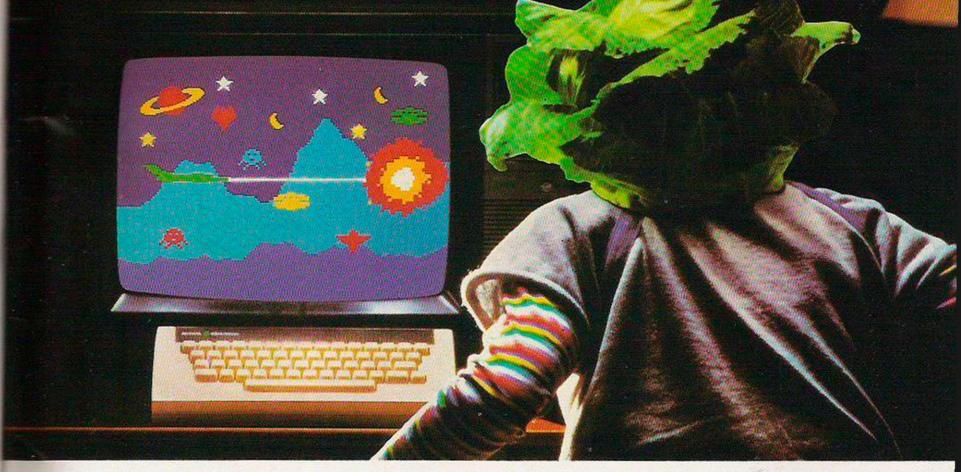
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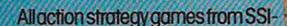
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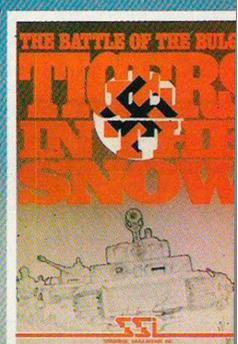
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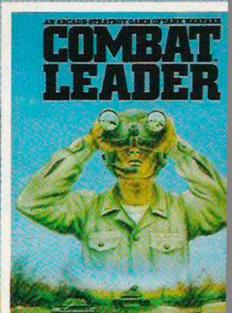
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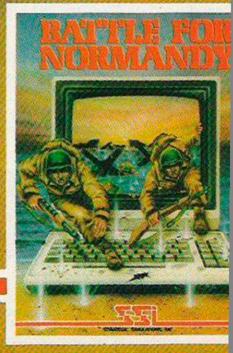


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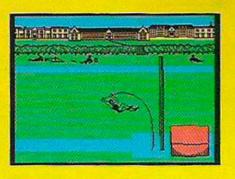




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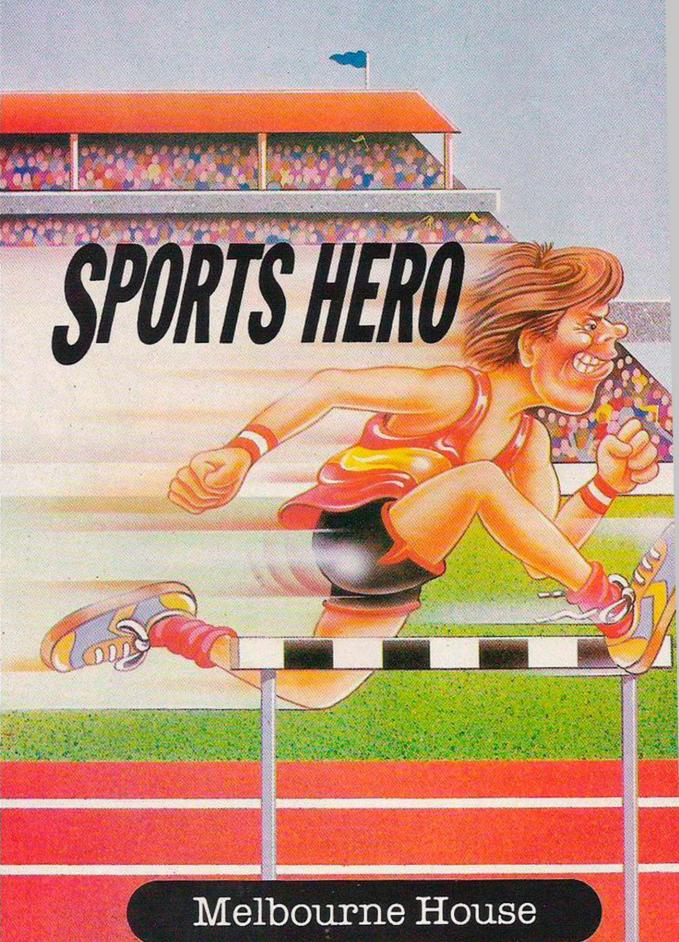
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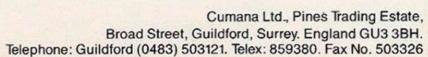
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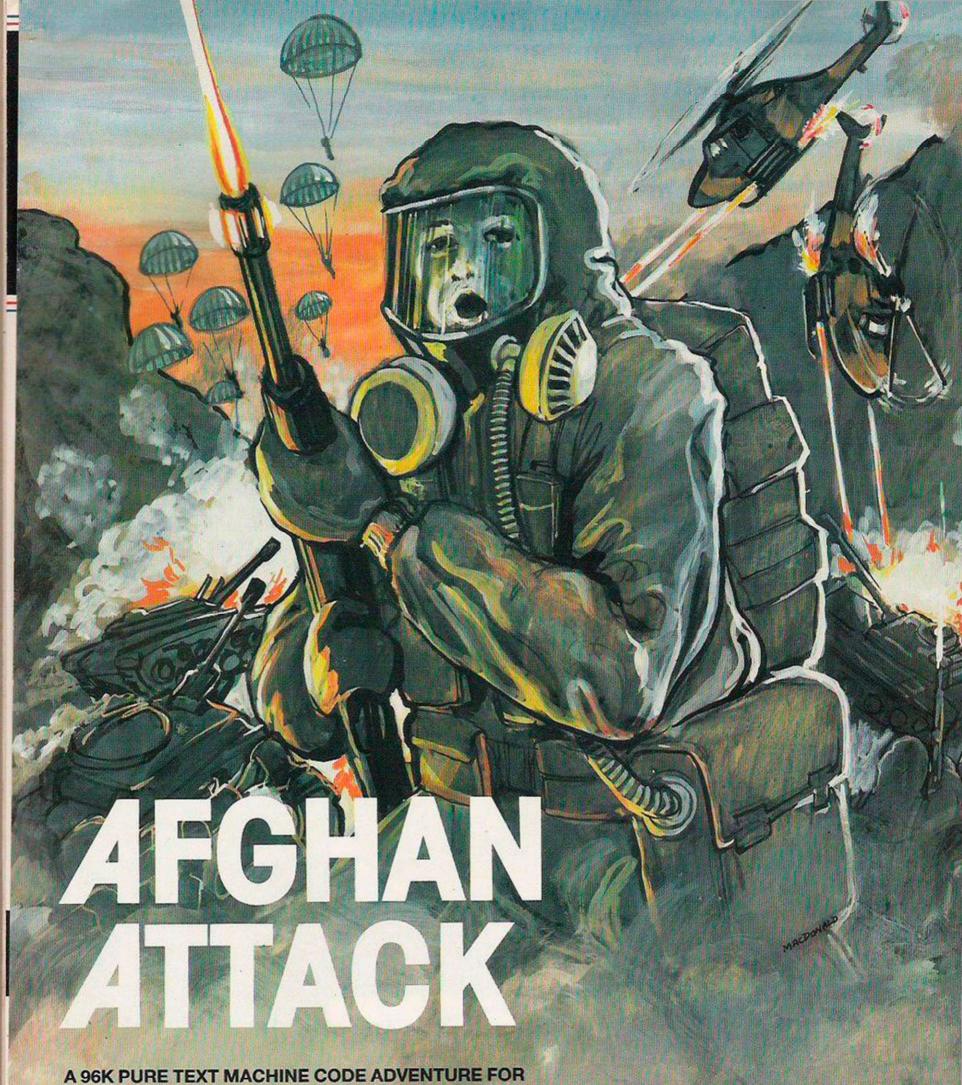
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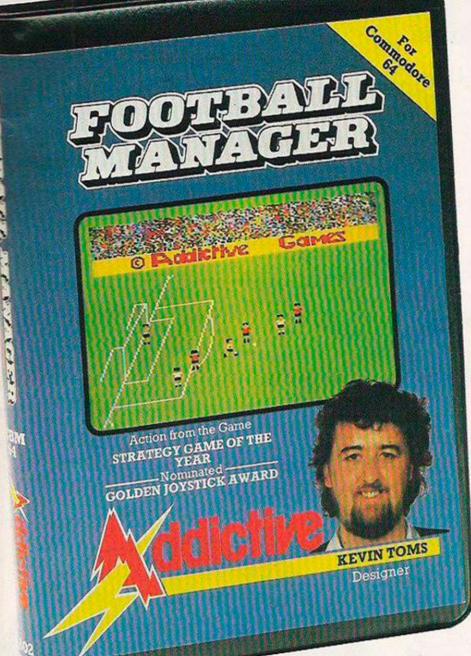


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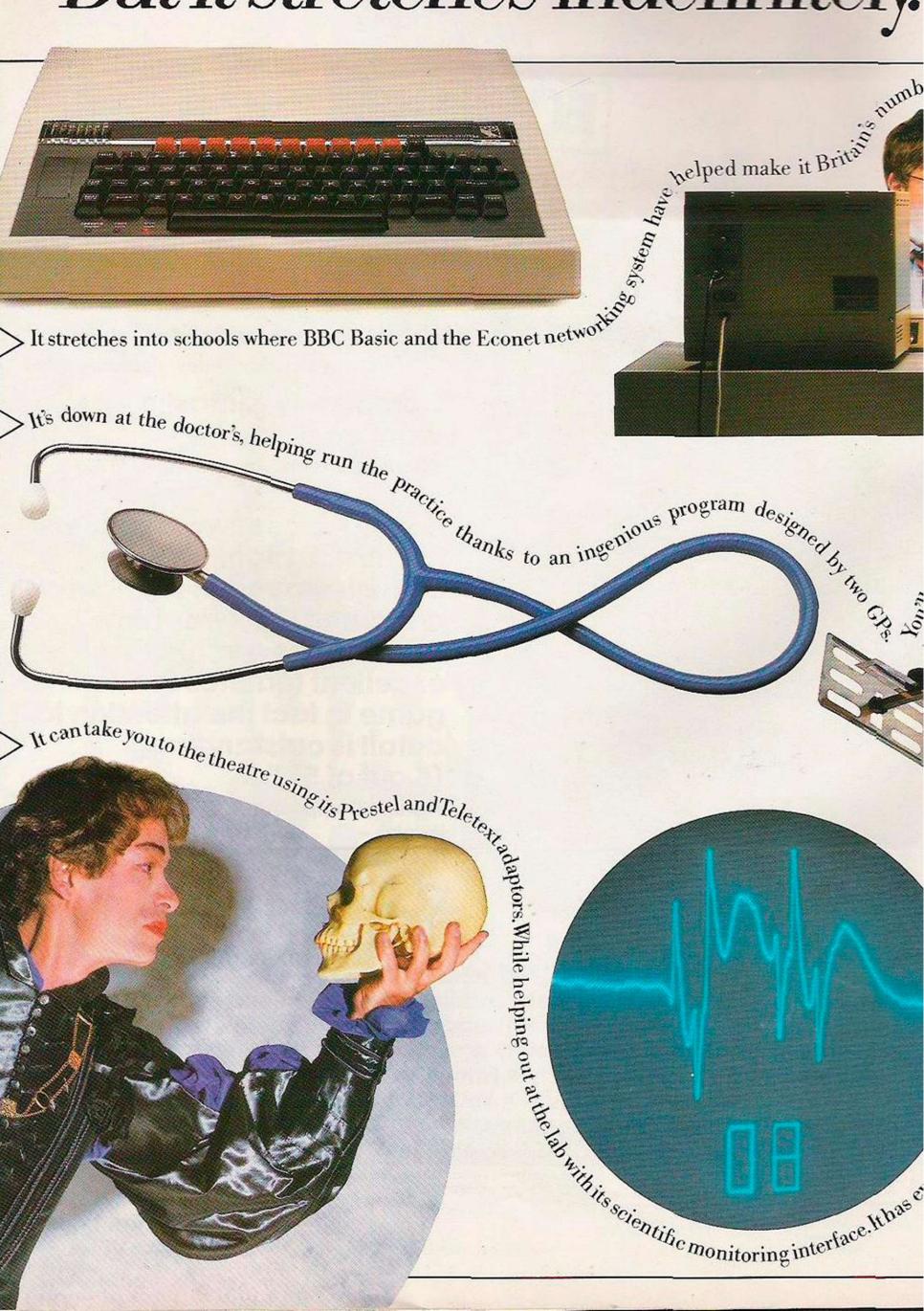
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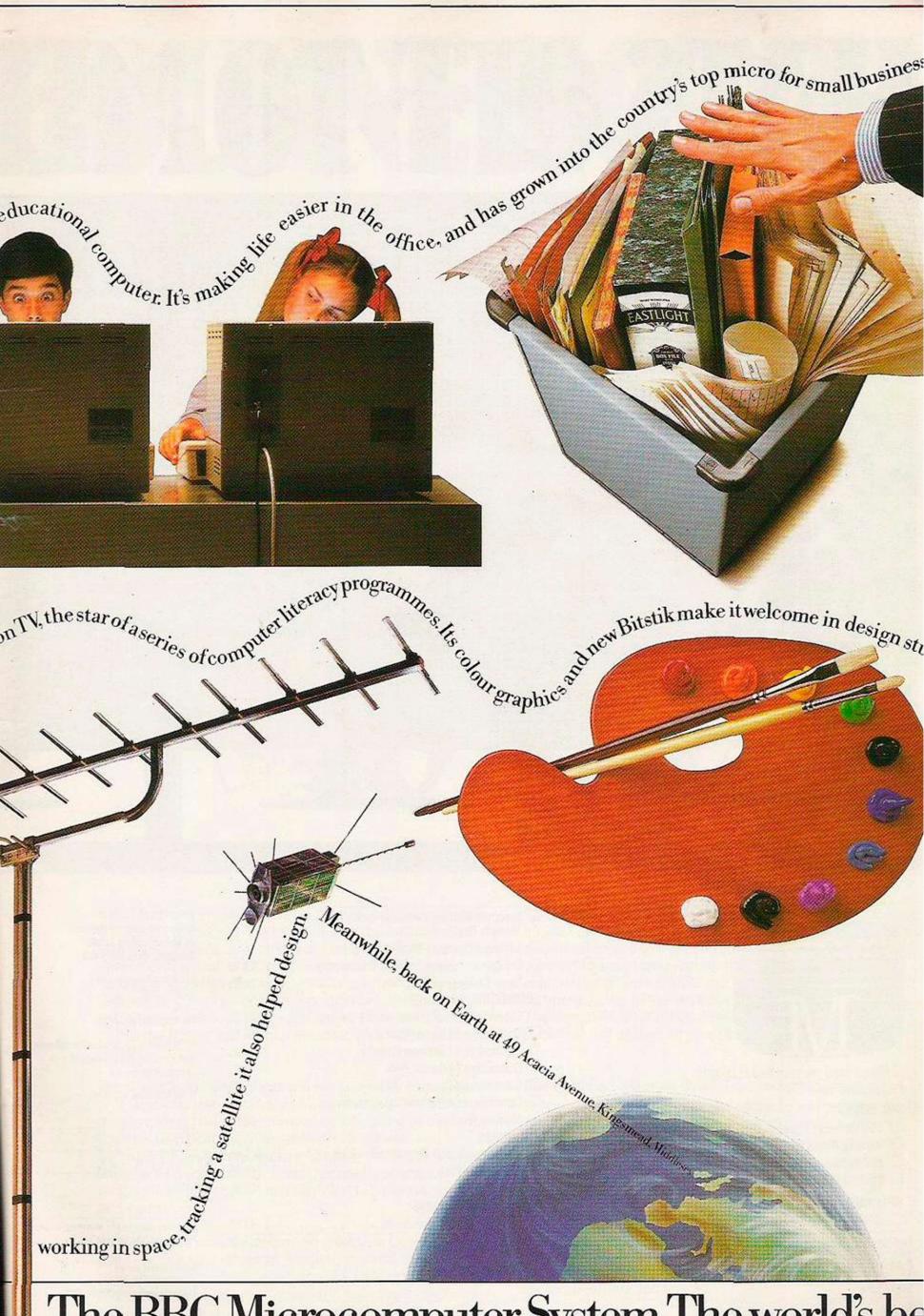
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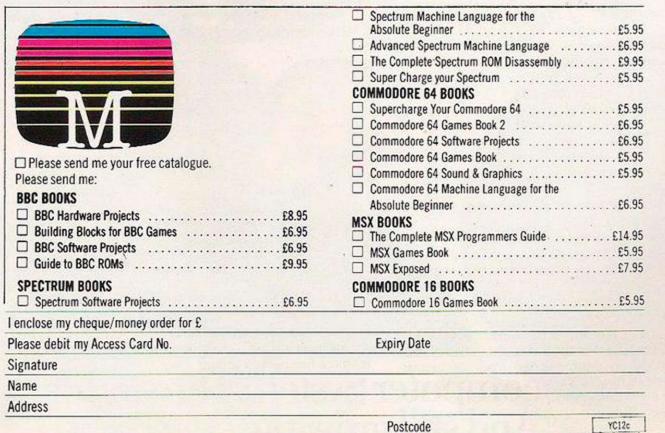


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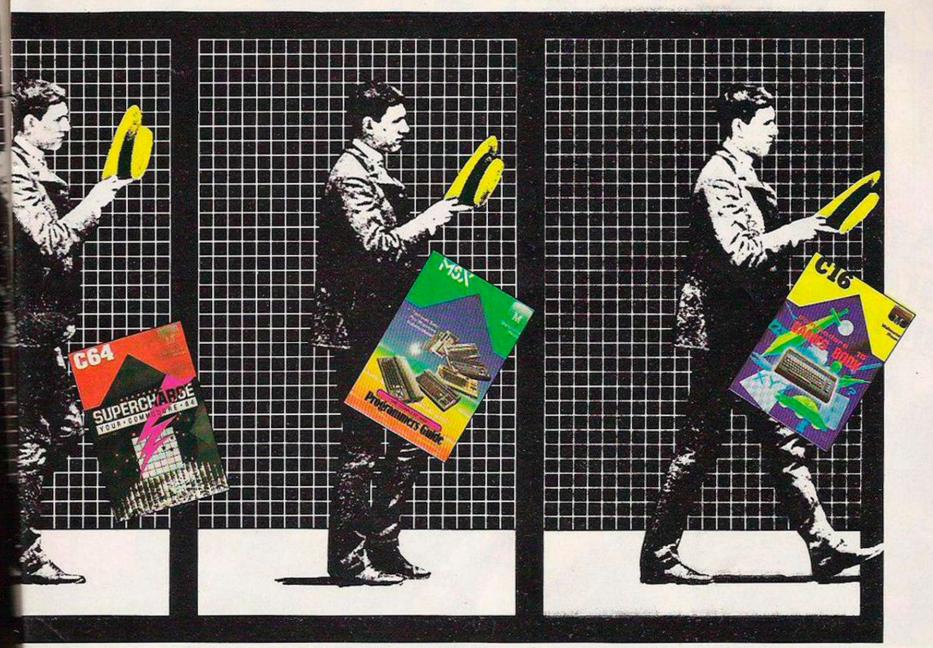
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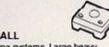
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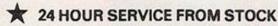
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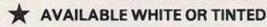
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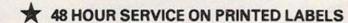
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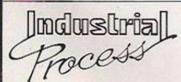
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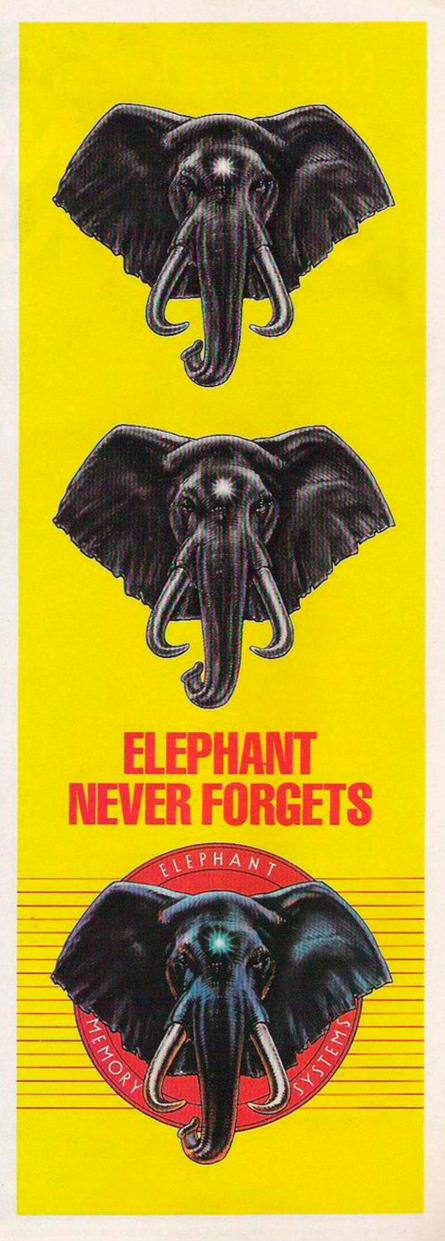
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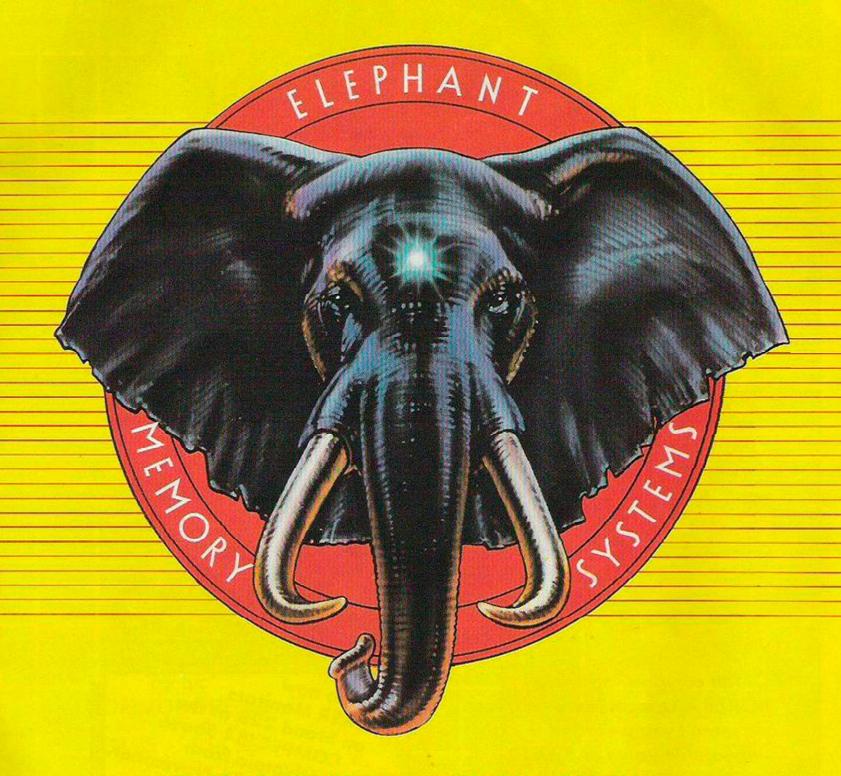
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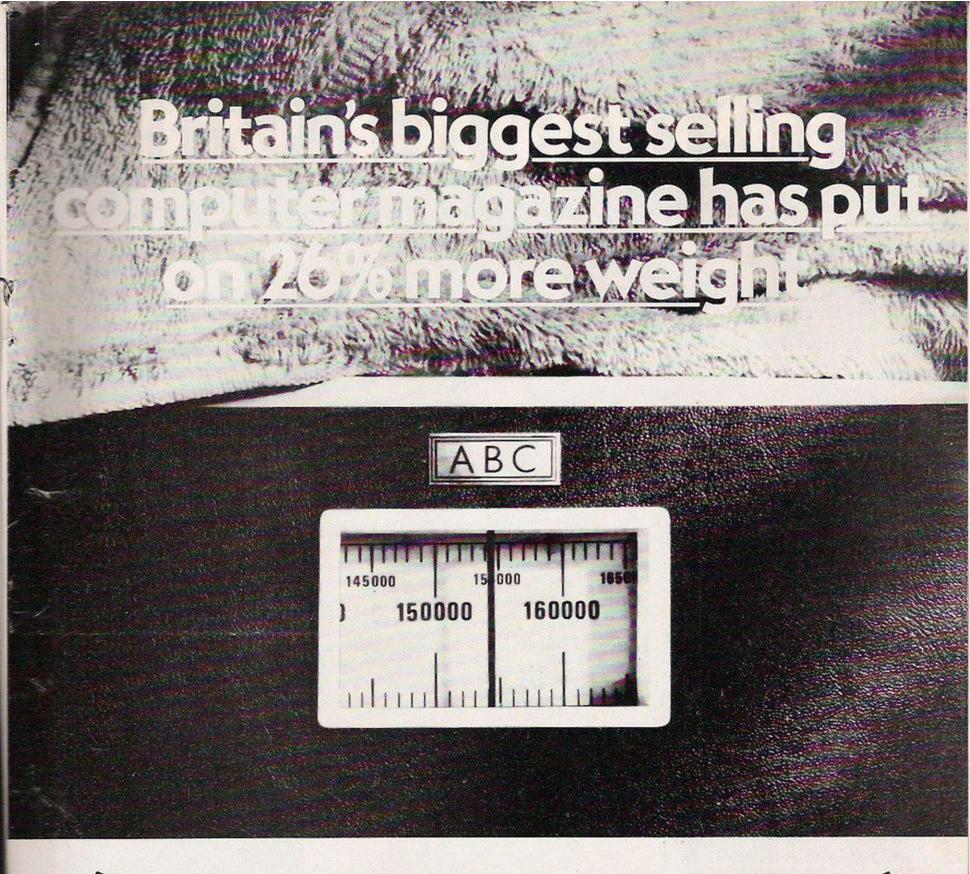
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For more details contact Shobhan Gajjar on 01-661 3127 Mand he'll explain why other home computer magazines could well have had their chips.



The new Mitsubisi

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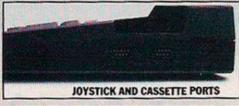
The sheer proliferation of computer and software systems flooding the market loudly underlined the need for a unified standard.

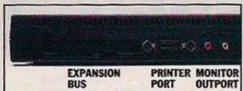
So the major companies jointly developed a single computer and software system. The result – MSX – the format that will be standard for all time.

And those in the know will not be surprised that Mitsubishi are in the vanguard of the MSX movement. For, with the F-series, Mitsubishi offers everything that MSX is and more.

GRAPHICS

Maximum resolution of 256 x 192 pixels with all 16 colours available on the screen at the same time. 32 sprites in two sizes and two magnifications allowing easy creation of '3D' graphics. 255 pre-defined characters all of which can be used as straight text or easily mixed with graphics.





SOUND

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KEYBOARD

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BASIC

MSX BASIC is possibly the most comprehensive version of the original language. There is a complete set of commands for creating graphics and sounds, manipulating text and moving sprites. In addition to this there are 'built-in' interrupt routines for detecting sprite collisions, function key selections and joy-stick fire buttons.

EXPANSION

The Mitsubishi 64k ML-F80 and 32k ML-F48 are both equipped with 2 cartridge ports, 2 joy-stick ports and a centronics compatible parallel interface. It is through these devices that the MSX system can be expanded for use with disc-drives, printers, serial interfaces, modems and other peripherals.

SOFTWARE ON CASSETTE

The MSX system can load and save data onto cassette at 1200 or 2400 baud and unlike certain other home computers, the Mitsubishi F-series can be used with a normal domestic tape recorder for this purpose.

When you put all of these features together, with the knowledge that Mitsubishi is the largest manufacturer of Mainframe computers in Japan, those in the know will immediately recognise the true potential of the Mitsubishi F-series.





i MSX Computers

For those who aren't

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FOR FATHER

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SPECIFICATIONS

Z80A (3.6 MHz)

Memory: ROM: 32 KB RAM: 64 KB (F80) RAM: 32 KB(F48)

Video Ram: 16 KB Screen Displays: *Text Mode:

40 columns x24 *Graphics:

256 x 192 pixels Colours: 16 (15+transparent) Sprites: 32 Output: RF,

Composite Video Keyboard: 73 moving-key keyboard

5 function keys Cursor control keys

Special keys for screen editing

Sound: 8 octaves 3 channels for sound or 'noise' Output by TV sound or External Audio

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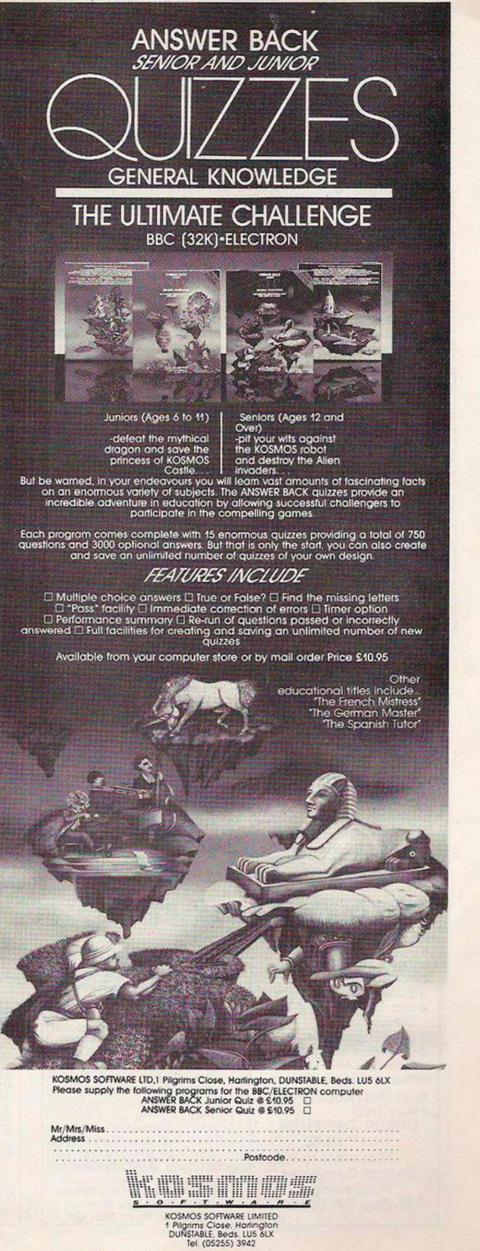
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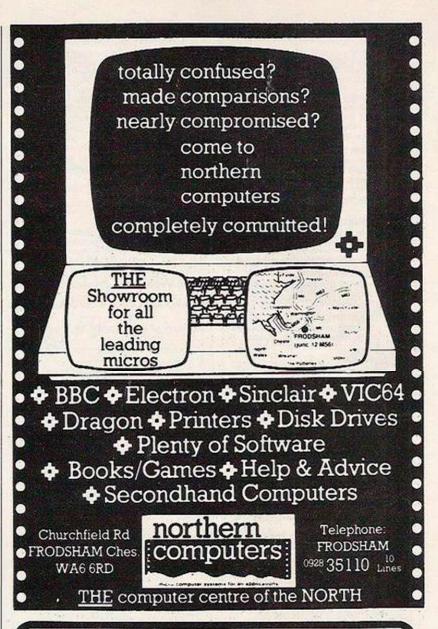
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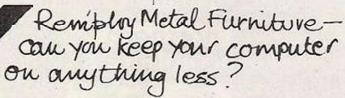
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Andy Andrews and John Wise — respectively chairman and managing director, Dennison Manufacturing Co. Ltd., and sales and marketing manager, Dennison Computer Supplies Division — in last minute, top level consultation prior to introducing the range of Elephant Memory Systems floppy discs to users in UK.

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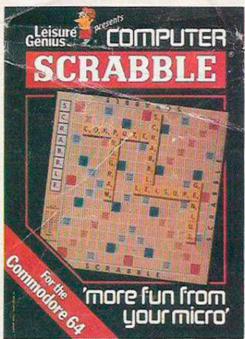
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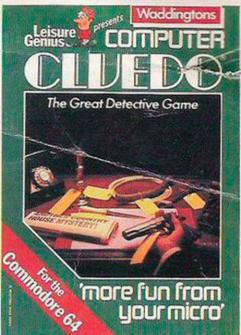
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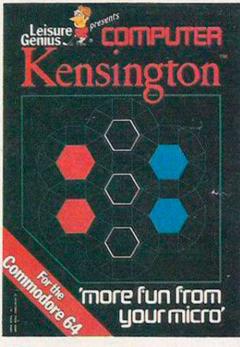
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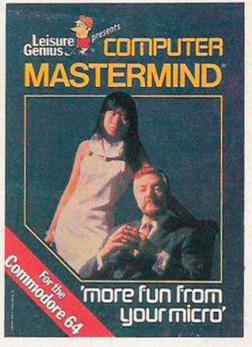
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